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Fostering Coastal Destination Resilience in Maine: Understanding Climate Change Risks and Behaviors

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FOSTERING COASTAL DESTINATION RESILIENCE IN MAINE: UNDERSTANDING CLIMATE CHANGE RISKS AND BEHAVIORS

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An Abstract of the Dissertation Presented
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Tourism is an increasingly important global industry. Coastal and nature-based tourism destinations are especially vulnerable to climate change. Trends in visitation are expected to shift under changing climate conditions, influencing tourist travel behaviors related to destination selection, timing of visits, and activity participation. Tourism suppliers' adaptation and mitigation behaviors have the potential to alleviate negative shifts in visitation and respond to negative climate change impacts, while also enabling suppliers to take advantage of emerging opportunities. The purpose of this dissertation is to understand how tourism stakeholders, including tourism suppliers (i.e., business owners, managers) and consumers (i.e., visitors), perceive their risk from climate change and how that impacts their behavioral responses. Applying theories of risk perceptions and community resilience, we used a mixed methods approach to understand factors that influence destination resilience and stakeholder climate change risk perceptions and actions. We employed in-depth interviews, archival evidence, and a visitor survey to gather data from study participants. In chapter 2, we used a phenomenological methodology to examine how tourism stakeholders in Machias, Maine are experiencing and adapting to climate change. Findings indicate that social networks centered around shared values,

beliefs, and sense of place, as well as engaged local governance, active knowledge sharing, and a sense of self-efficacy all contributed to agency in addressing coastal flooding. In chapter 3, we used a survey to measure drivers of visitors' climate change risk perceptions in Acadia National Park, Maine. Significant predictors included identifying as female, having higher belief in climate change, having more first-hand experience with climate change impacts, and having a higher altruistic values orientation. In chapter 4, we used a case study methodology to understand the influence of supplier and visitor climate change risk perceptions and behavioral responses on destination resilience. Our findings show where areas of overlap between tourism supplier and visitor experiences, perceptions of threats, and behavioral responses can contribute to destination resilience. The ability of Maine' tourism industry to assess their risk from climate change, adapt to impacts, and anticipate socio-ecological changes will influence system resilience to respond to climate change and potentially other shocks and stressors.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

Tourism is a growing global industry and can be especially important in supporting economic development in rural areas where traditional extractive industries are in decline (Dong, Wang, Morais, & Brooks, 2013; UNWTO, 2020). Nature-based tourism relies on natural features to support tourism and outdoor recreation and can be a livelihood alternative in areas with few built attractions and limited tourism structure. This reliance on environmental features makes nature-based tourism destinations especially at risk to climate change impacts. Coastal areas are identified as one of the most climate vulnerable types of tourism destinations (UNWTO, 2016). Climatic changes and resulting impacts that may affect the tourism industry include sea level rise, extreme weather events, flooding, saltwater intrusion, erosion, and ocean acidification (Wong et al., 2014). In addition to facing these changes in biophysical conditions, tourism destinations will also see changes in visitation patterns as a result of climate change, such as shifting the timing of visits and changing activity participation, though these changes are expected to vary across visitor characteristics (Gössling, Scott, Hall, Ceron, & Dubois, 2012; McCreary, Seekamp, Larson, Smith, & Davenport, 2019). Nature-based tourism destinations, therefore, have to manage for uncertain climate impacts to the natural assets as well as changes to the flow of visitors upon which they rely.

It is important to understand how tourism suppliers intend to react to socio-ecological conditions resulting from a changing climate (Shakeela & Becken, 2015), while also understanding how visitor travel decisions may shift under climate uncertainties (Gössling et al., 2012). By studying perceptions of and responses to climate change within tourism destinations, we can begin to understand what factors shape destination resilience—or the ability of

destinations to anticipate and respond to changes and uncertainties (Hopkins & Becken, 2014). Successful tourism development is a function of how well the supply side meets demand, and matching supply and demand is an continuous, dynamic process (Formica & Uysal, 2006; Gunn & Var, 2002). Predicting shifts in visitation patterns and changing demands as a result of climate change can help tourism suppliers proactively respond to changing visitor expectations and behaviors, helping them provide high quality tourism experiences that also generate economic development in rural areas (Amelung & Moreno, 2012; Gunn & Var, 2002). Misalignments between visitor demand and supplier products and services can result in negative visitor interactions, a decline in visitation over time, and negative impacts to tourism suppliers' livelihoods (Gunn & Var, 2002).

1.2 Theoretical Foundations

In this dissertation we focus on the concepts of risk perceptions and community resilience to help understand how nature-based tourism stakeholders, both suppliers and consumers, perceive their risk from climate change and how, if at all, stakeholders respond to the impacts of climate change. In the following sections, we outline relevant concepts and models from previous studies that I incorporate into the field of tourism and outdoor recreation. We begin by discussing models and significant psychological and social determinants of risk perceptions before discussing resilience with a focus on community resilience.

1.2.1 Risk Perceptions

Risk can be defined as the ‘‘things, forces, or circumstances that pose danger to people or to what they value’’ and is often described in terms of a likelihood or probability of loss occurring (McComas, 2006, p. 215). In contrast, risk perceptions are more subjective in nature, acknowledging the complex ways individuals internalize, interpret, and make sense of risks

(Bodemer & Gaissmaier, 2015). Climate change risk perceptions are specifically directed to information processing and sensemaking related to climate change as an external threat, phenomenon, or situation (Shakeela & Becken, 2015). The difference between objective risk and risk perceptions is critical and the two do not always align, making it important to go beyond understanding objective risk to comprehend risk perceptions. Several models have been widely used to understand risk perceptions and behavioral intentions, including the Risk Information Seeking and Processing (RISP) model, the Social Amplification of Risk Framework (SARF), and more recently van der Linden's social-psychological climate change risk perception model (CCRPM).

The RISP model combined elements of the heuristic-systematic processing model, Slovic's psychometric paradigm, and the Theory of Planned Behavior to examine how people seek and process risk communications in a systematic way (Ajzen, 1991; Bodemer & Gaissmaier, 2015; Yang, Aloe, & Feeley, 2014). The RISP model posits that the gap between what people know and what they perceive they need to know (information sufficiency) will influence information processing (i.e., heuristic or systematic) and information seeking (i.e., active, routine, avoidance) behaviors (Dunwoody & Griffin, 2015) (Figure 1).

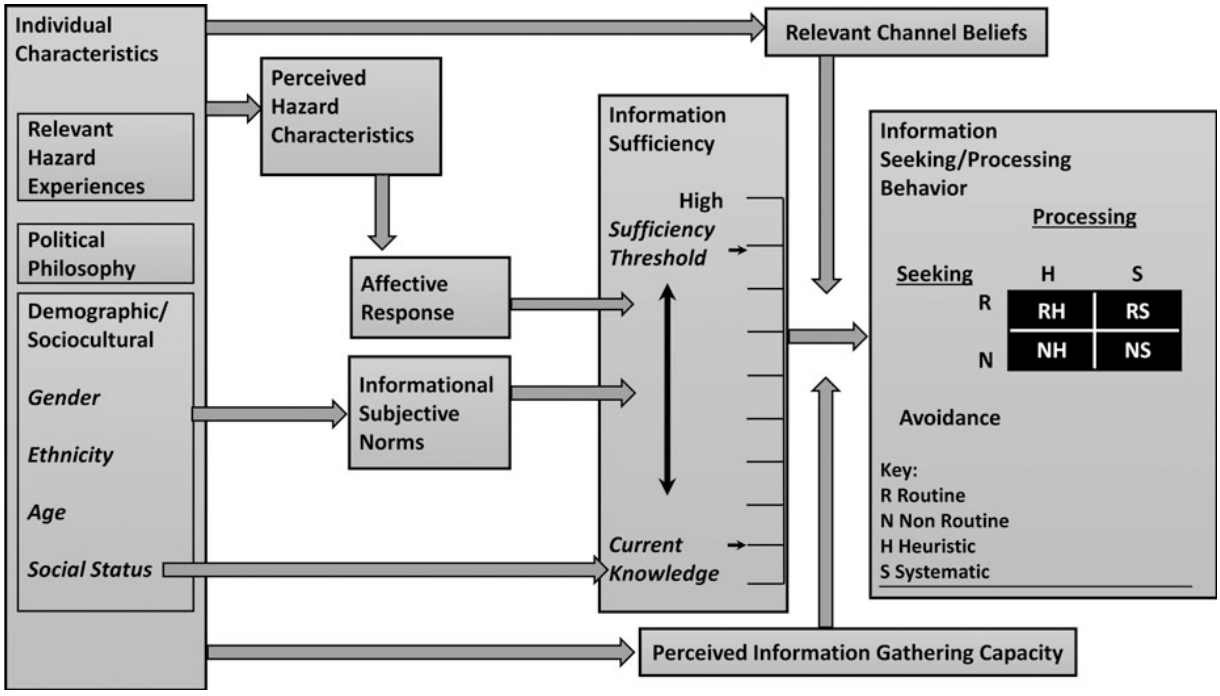

Figure 1. The Risk Information Seeking and Processing (RISP) model (Dunwoody & Griffin, 2015).

The perceived information gap judgment will stem from an array of factors. These factors include individual characteristics, such as socioeconomic status and ideological preferences, perceptions of the hazards posed by the risk, the level of worry about the risk, and perceived social normative pressures to learn about the risk (Dunwoody & Griffin, 2015). Achieving information sufficiency is a function of affective responses to a risk and beliefs about what others think they should know about the risk (normative pressure) (McComas, 2006). The RISP model predicts that perceived information availability and self-efficacy in information gathering will influence the link between a person's perceived information gap and information seeking and processing behavioral intention (Yang, Rickard, Harrison, & Seo, 2014). This model is especially useful in understanding cognitive factors influencing risk perceptions and how those, in turn, influence information seeking and processing behaviors (Dunwoody & Griffin, 2015); however, a recent meta-analysis suggests that the heuristic predictive power of the RISP model is

limited. Yang et al. critique that information insufficiency may not determine information seeking and processing behaviors and suggest that existing knowledge about the risk and informational subjective norms account for much of the variance in seeking behaviors (Yang, Aloe, & Feeley, 2014).

The SARF model emerged from communication theory and describes how risks are communicated, how communication processes influence risk perceptions, and how communication, in turn, influences the risks themselves (ripple effects) (Kasperson et al., 1988). The SARF explains how complex flows of information (involving signals, transmitters, and receivers interacting with each other) lead to an intensification or amplification of a risk message or to its attenuation (Shakeela & Becken, 2015) (Figure 2).

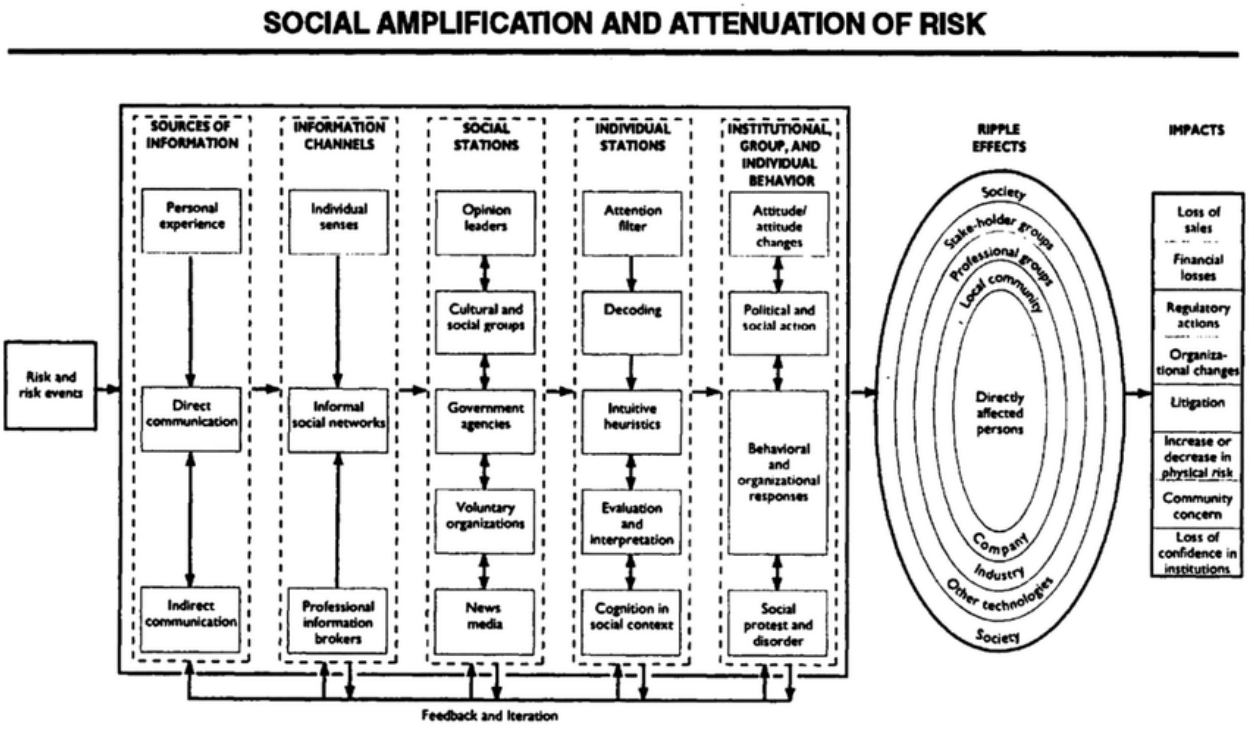

Figure 2 The Social Amplification of Risk Framework (SARF) (Kasperson et al., 1988).

Message receivers process risk events through personal and social amplification and attenuation stations that determine risk perceptions. There are two main stages in the social

amplification/attenuation of risk process: information transfer about the risk and the societal response (Mase, Cho, Prokopy, 2015). These risk perceptions interact at different scales, creating ripple effects, meaning that risks can move beyond the individual level and result in a range of larger scale, societal impacts (Kasperson et al., 1988). The SARF argues that risks have a meaning within a sociocultural context (Kasperson et al., 1988). The novelty of the model is its attempt at incorporating socially constructed perceptions of risk, acknowledging that psychological, social, institutional, and cultural factors influence risk perceptions (McComas, 2006). Criticisms of the SARF include limited understanding of how risk messages are co-created, the challenge in transitioning from abstract concepts in the model to measurable constructs, and the model's lack of predictive power (Mase, Cho, & Prokopy, 2015; van der Linden, 2015; Wardman, 2008).

Van der Linden's CCRPM combines social and psychological elements from the RISP and SARF and is especially applicable to this dissertation as it focuses specifically on climate change risk perceptions, views that evaluate and make sense of climate change as an external threat or hazard (Figure 3). Van der Linden's model arose from an extensive review of the literature and combines elements from social and psychological constructions of risk perceptions. His model describes climate change risk perceptions as a function of cognitive factors (i.e., cause, impact, and response knowledge), experiential processing (i.e., affect and personal experience with impacts) and socio-cultural influences (i.e., social norms and value orientations) while controlling for socio-demographic characteristics (i.e., gender, age, education, income) (van der Linden, 2015). Van der Linden acknowledges that his model is not exhaustive but the combination of measurable social and psychological predictors provides a holistic understanding of climate change risk perceptions (van der Linden, 2015). I use van der Linden's CCRPM to

guide this dissertation. In the following sections, I outline some important determinants of risk perceptions based on prior studies, including socio-demographic, cognitive, experiential, and socio-cultural factors.

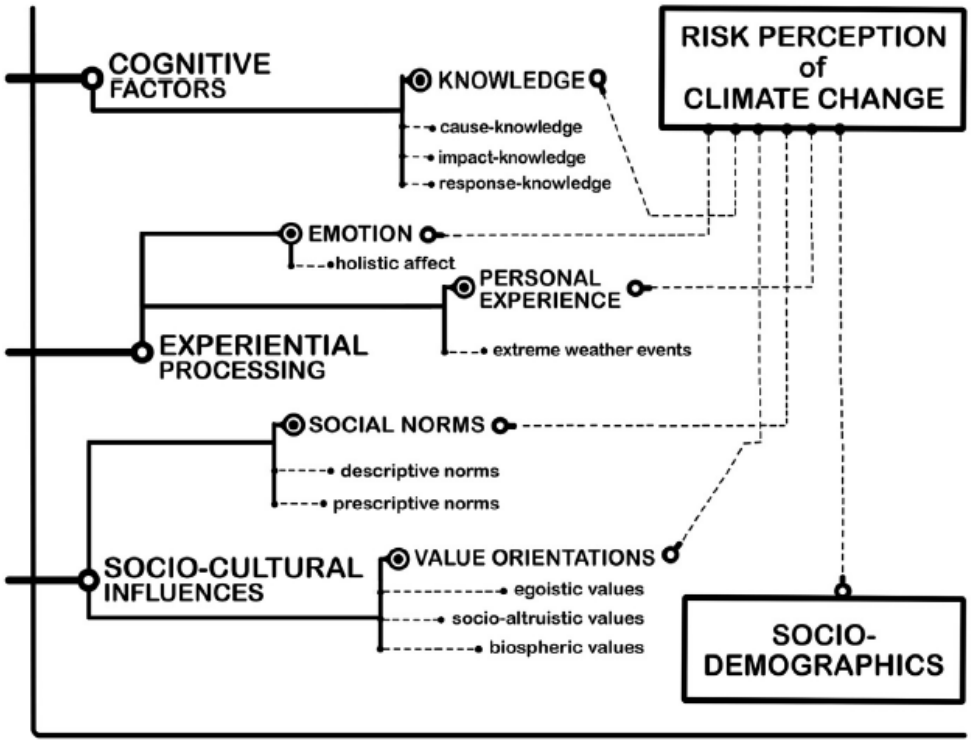

Figure 3. Van der Linden's climate change risk perception model (CCRPM) (van der Linden, 2015).

1.2.1.1 Socio-Demographic Influences

Previous studies have found gender, age, and political affiliation to be important predictors of risk perceptions. Females tend to perceive their risk from climate change as higher than men (De Urioste-Stone, Scaccia, & Howe-Poteet, 2015; Finucane, Slovic, Mertz, Flynn, & Satterfield, 2000; Mase, Cho, & Prokopy, 2015; Scannell & Gifford, 2011). This is perhaps due to the "white male effect," whereby white men tend to have lower risk perceptions than women and minorities (Finucane et al., 2000), though this effect becomes less pronounced when only considering differences between groups of males. In the same study, authors found that white

participants had lower risk perceptions than non-white participants, indicating that perhaps white males, who typically occupy positions of power and control, perceive the world to be less dangerous than minority groups who tend to be more vulnerable to hazards (Finucane et al., 2000).

An additional socio-demographic factor that can influence risk perceptions is age. While older age typically is associated with higher risk perceptions, in the case of climate change the opposite can be true, if there is a significant relationship found at all. In a recent study of visitors to Acadia National Park, younger visitors perceived their risk from climate change as higher than older participants (De Urioste-Stone et al., 2015). This makes sense when thinking about climate change as the most severe impacts are expected to impact future generations.

Political affiliation has been another important socio-demographic variable worthy of consideration in climate change risk perception studies. In a survey of US and Singapore residents, political affiliation was a moderator influencing the strength of the relationship between distancing and policy support (Rickard, Yang, & Schuldt, 2016). A study of United Kingdom residents found that more liberal participants had significantly higher risk perceptions than conservative participants (van der Linden, 2015); however, political affiliation is not always a significant predictor of climate change risk perceptions (Kellstedt, Zahran, & Vedlitz, 2008)

To our knowledge, there have been few explanatory links between other socio-demographic variables, such as education level and socio-economic status, and climate change risk perceptions (Akerlof, Maibach, Fitzgerald, Cedeno, & Neuman, 2013). Previous studies indicate that, in general, women, non-whites, younger, and liberal individuals perceive their risk from climate change as higher than men, whites, older, and conservative individuals (De Urioste-Stone, Le, Scaccia, & Wilkins, 2016; Finucane et al., 2000; Safi, James, & Liu, 2012; van der

Linden, 2015). These socio-demographic factors play at least a minor role in accounting for group differences in risk perceptions and behavioral responses.

1.2.1.2 Cognitive

Cognitive factors influence risk perceptions, including knowledge of climate change, belief in anthropogenic climate change, and perceived efficacy. People with access to climate change information can begin to think about its impacts, making perceived risks more salient and potentially increasing demand for mitigation action (Milfont, 2012; Yang et al., 2014); therefore, increased knowledge of climate change is often associated with increased levels of concern and higher perceived risk (Milfont, 2012; Pidgeon, 2012; van der Linden, 2015). Van der Linden's CCRPM also incorporates measures of knowledge, including cause knowledge (what causes climate change?), impact knowledge (what are climate change impacts?), and response knowledge (how can I/we respond effectively to climate change?). In his national survey of UK residents, cognition, while a significant predictor, explained only 9.3% of the variance in risk perceptions (compared to 22.1% explained by experience and 34.4% explained by socio-cultural factors) (van der Linden, 2015). In the same study, an interesting finding was that impact knowledge and response knowledge explained more variation in risk perceptions than cause knowledge (van der Linden, 2015), indicating that the distinction between man-made and naturally occurring climate change was less important for determining climate change risk perceptions in that study context.

Belief is often a precursor to behavioral intentions, such as described by the Value-Belief-Norm Theory and the Theory of Planned Behavior (Stern, 2018). In the Value-Belief-Norm Theory, values shape environmental beliefs that activate norms and result in certain behaviors, while in the Theory of Planned Behavior, beliefs shape attitudes, subjective norms,

and perceived control to influence behavioral intention (Ajzen, 1991; Stern, 2018). In the context of this dissertation, we are interested in belief in anthropogenic climate change, the idea that climate change is occurring because of human actions and that we are not experiencing a natural warming. While we use belief in climate change as an explanatory variable in this research, belief is influenced by many factors, including life experiences, values, cognitive biases, and socio-demographics (Brownlee, Powell, & Hallo, 2012; Hamilton & Stampone, 2013). Belief in anthropogenic climate change increases risk perceptions (Safi et al., 2012) and is often associated with values and norms (Heberlein, 2012), which can be influenced by your identity within a group such as your political affiliation. For example, Hamilton and Stampone (2013) found that Republicans and Democrats had strong anthropogenic climate change beliefs while Independents, who had weaker beliefs, were more likely to be influenced by factors such as the temperature on the day they were interviewed.

Perceived self-efficacy is the feeling that one's actions will or will not make a difference in mitigating the effects of climate change. Within the RISP model, perceived information gathering capacity refers to how successful an individual believes themselves to be at addressing the information gap. Low self-efficacy can prevent information seeking before any actions are taken (Dunwoody & Griffin, 2015). Similarly, lower perceived efficacy contributes to lower risk perceptions (Brownlee, Powell, and Hallo, 2013; Milfont, 2012) and can result in inaction due to feelings of hopelessness (Dillimono & Dickinson, 2014). It has become clear that a greater understanding of individual cognitive processes, such as climate change knowledge, belief in anthropogenic climate change, and perceived efficacy, is critical to explaining risk perceptions and resulting behavioral changes and should be understood in connection with social processes.

1.2.1.3. Experiential Processes

Information processing is often described as taking place within two systems (Kahneman, 2011), a model similar the Heuristic Systematic Model that forms the basis of the RISP framework (Eagly & Chaiken, 1993). Past experience and affect have become increasingly recognized as critical filters and systems through which we understand and process our world. System 1, the affective, heuristic and experiential system, is rapidly able to assess situations using a variety of mental shortcuts, such as drawing from past experiences and making associative connections, to help us arrive at a conclusion (Kahneman, 2011; Slovic, Finucane, Peters, & MacGregor, 2004). In contrast, System 2 is the slower, more analytical, systematic and deliberative information processing system that enables employing logic, reasoning, and evidence-based decision-making strategies to make choices (Kahneman, 2011; Slovic, Finucane, Peters, & MacGregor, 2004).

In the context of risk perceptions, experiential processes, or System 1, focuses on the influence of personal experiences and affect on risk perceptions. Experiencing an event first hand that is perceived to be the result of climate change usually equates to higher risk perceptions (Milfont, 2012; Pidgeon, 2012; Spence, Poortinga, & Pidgeon, 2012; van der Linden, 2015). However, Safi et al. (2012) found that drought in Nevada did not contribute to higher perceptions of risk among farmers and ranchers, possibly because drought is viewed as a natural occurrence in the area and was thus not cognitively linked to climate change. Consequently, the type of environmental impact may play an important role in determining risk perceptions.

In addition to personal experiences with climate change, emotions can determine risk perceptions, as System 1 information processing can be guided by affect, defined as a conscious or subconscious feeling along a positive–negative continuum (Dickert, Västfjäll, Mauro, &

Slovic, 2015). Van der Linden found that experience with climate change impacts, defined as both past experience with extreme weather events and affect toward climate change, predicted 22% of the variance in risk perceptions (van der Linden, 2015). Furthermore, van der Linden's 2014 study of climate change risk perceptions revealed that affect was the most important predictor, explaining over 20% of variance in risk perceptions (van der Linden, 2014). It seems unlikely that we can process risks solely through cognitive dimensions without including the influence of affect throughout the process, indicating that risk-as-feelings must be considered in addition to the role of previous experience when understanding risk perceptions (Slovic, Finucane, Peters, & MacGregor, 2004).

1.2.1.4 Socio-Cultural

With the acknowledgement that risk is in part socially constructed, the importance of social processes, such as culture, values, and norms, are crucial to understanding how individuals and societies perceive risks. According to the SARF, risks are filtered through sources of amplification, such as personal experience and direct and indirect communication, and via channels of amplification, such as informal social networks and professional information brokers (Kasperson et al., 1988). Risks are then processed through those social and individual stations to either amplify or attenuate a risk, resulting in group and individual responses, such as social protest, behavioral modifications, and attitude change (Kasperson et al., 1988). This helps explain why certain hazards become widespread concerns within society as risk perceptions can be much higher than objective risk.

Cultural and social groups are important social amplification (or attenuation) stations that shape how individuals perceive risk. For example, Masuda and Garvin (2006) found that risk amplification and attenuation depended on experiences related to cultural worldviews that were

supported by group views on place attachment and whether the area was viewed as a desirable place to work or a place to live (Masuda & Garvin, 2006). While culture is certainly a filter through which we interpret risks, measuring culture is difficult. Van der Linden operationalizes culture through three values orientations: biospheric, altruistic, and egoistic. Values can be defined as single, stable beliefs that guide attitudes and actions (Heberlein, 2012). Van der Linden's study of climate change risk perceptions found that socio-cultural factors, where he included norms and values (as a proxy for culture), explained the greatest amount of variance in risk perceptions (34.4%) (van der Linden, 2015).

Closely related to values and culture are social norms, the common rules or behavioral expectations within a group (Dunwoody & Griffin, 2015). Norms mediate individual agency (Dillimono & Dickinson, 2015) and the more people act upon the risk of climate change, the more prevalent the issue becomes in society and the more amplified an individual's risk perception (van der Linden, 2015). For example, Kahan et al. found that the cultural lenses through which individuals processed climate change information, as well as the expectations of their cultural peer group (norms), were important in shaping climate change risk perceptions (Kahan et al., 2012). This points to the importance of considering socio-cultural factors when understanding risk as they have at times been overshadowed by the role of cognition and facts in shaping risk perceptions.

1.2.2 Resilience Thinking and Community Resilience

Resilience is the capacity of a system to absorb disturbance and reorganize while undergoing change so as to retain essentially the same function, structure, identity, and feedbacks through either recovery or reorganization in a new context (Adger et al., 2011; Chapin, Folke, & Kofinas, 2009). Resilience is often conceived of as the amount of change the system can undergo

and still remain within the same domain of attraction toward which the system tends to go and remain in the absence of strong stressors or shocks (Gallopín, 2006). While resilience is often thought of as a positive system attribute, it is important to note that resilience can be a negative attribute, such as a system refusing to or unable to change. In contrast to steady state management principles, resilience thinking recognizes that complex adaptive systems are constantly changing in ways that cannot be predicted or controlled, ensuring that decisions are always being made in a state involving some level of uncertainty (Chapin et al., 2009). Therefore, resilience thinking often focuses on fostering small-scale diversity to maintain those components of the socio-ecological system that are well adapted to each other, reducing the likelihood that disturbances, which will inevitably occur, will have devastating effects to the system (Chapin et al., 2009).

While resilience was first developed in relation to ecological systems, the concept has more recently been applied to social systems at different spatial and temporal scales. In the context of tourism and this dissertation, the concept of community resilience can be useful to study tourism destination resilience. Community resilience can be defined as a community's ability to maintain, renew, or reorganize its function in a system characterized by change and uncertainty (Magis, 2010; Varghese, Krogman, & Beckley, 2006). Community resilience is determined by having resources and being able to use those resources in a way that empowers stakeholders (Maclean, Cuthill, & Ross, 2014). This concept of agency is a key difference between ecological and social resilience. Human agency refers to the ability to make choices that can have system-wide impacts (Chapin et al., 2009). Agency can enable human systems to postpone ecological impacts (to some extent), innovate (e.g., technology), consciously recognize

future scenarios, and collectively act in ways that reduce risk and can transform a system (Davidson, 2010).

The ability to think to the future and respond proactively refers to adaptive capacity, which is the ability for long-term planning within a system characterized by uncertainty and change (Chapin, Folke, & Kofinas, 2009). Adaptive capacity is a balance between stabilizing feedbacks to buffer against disturbances and innovation to enable opportunities for change and the ability to adjust governance structures to meet changing needs (Chapin et al., 2009). Adaptive capacity is a precondition necessary to enable adaptation and the ability to mobilize assets (Adger et al., 2011). Adaptive capacity includes both the resources available to respond to change within a system and the ability of system actors to deploy them. Being well adapted does not necessarily mean a community is resilient. You can be well adapted to a specific condition but not able to respond to change or other conditions very well. Adaptive capacity relies on individuals and groups to learn how their system works and how and why it is changing, as well as creating space for experimentation and innovation to test that understanding (Chapin et al., 2009). Without experimentation and innovation, a system will have to rely only on buffers to resist change rather than being able to embrace change. As described above, a balance between stabilizing buffers and innovative changes is essential to long-term planning and building resilience (Chapin et al., 2009).

1.3 Problem Statement

Globally, tourism is an important economic industry (UNWTO, 2020). Climate change is already affecting tourism worldwide (Oppenheimer et al., 2014). Climate is often a key factor in destination selection (Hendrik & Jeuring, 2017; Lise & Tol, 2002); therefore, climate change is expected to alter visitation patterns and impact host economies (Amelung, Nicholls, & Viner,

2007; Scott, Stefan, & Hall, 2012). Fundamental to a functioning tourism system is the relationship between supply and demand, the ability of a destination to offer a desirable product to consumers (Gunn & Var, 2002).

Climate change risk perceptions can influence the supply-demand match by altering the appeal of the destination or by influencing tourism supplier actions that indirectly influence destination attractiveness (Huebner, 2012). For consumers, climate change risk perceptions can influence destination selection, activity participation, and seasonal visitation patterns (De Urioste-Stone, Le, Scaccia, & Wilkins, 2016; Karl, 2018; Perry, Manning, Xiao, & Valliere, 2018). Visitors are often described as having the greatest ability to adapt or change their travel behavior (Dawson, Scott, & Havitz, 2013). Changes in visitation from climate change will result in increased visitation in some destinations, especially summer destinations in traditionally cooler climates, while other destinations experience a loss in visitor numbers (Fisichelli, Schuurman, Monahan, & Ziesler, 2015; Gössling et al., 2012; Maddison, 2001). On the other hand, for suppliers, understanding visitor climate change risk perceptions and expectations could help tourism businesses and planners in coastal destinations adapt to continue to meet visitor expectations, target emerging markets, and understand changes needed to respond to environmental and physical conditions resulting from climate change. Assessing visitors' perceptions of risk can aid tourism businesses, planners, and managers in understanding how travel behavior may be influenced by changes in climate, thereby aiding adaptation and management efforts.

Climate change risk perceptions can influence tourism suppliers' decisions to adapt or mitigate (Csete & Szécsi, 2015; Kettle & Dow, 2016; Shakeela & Becken, 2015), though many barriers to action remain (Saarinen, Hambira, Atlhopheng, & Manwa, 2012). Tourism suppliers'

behavioral responses have the ability to offset climate change impacts that may negatively affect visitation (Atzori, Fyall, & Miller, 2018). Adaptation and mitigation initiatives within tourism destinations can potentially alleviate consumer concerns, improve visitor satisfaction, and contribute to the overall appeal of the destination. Understanding tourism suppliers' risk perceptions of climate change in coastal tourism destinations can help identify barriers and facilitators to mitigation and adaptation initiatives to cope with negative impacts and take advantage of potential opportunities. Without an adequate understanding of visitor risk perceptions and potential shifts in travel behaviors, tourism providers might implement ineffective or potentially environmentally harmful mitigation and adaptation plans. The combined understanding of visitor and tourism supplier climate change risk perceptions in coastal tourism destinations can help contribute to ongoing management efforts to achieve long-term sustainability and competitiveness within the tourism industry, while enhancing resilience.

Within the context of this dissertation, we are specifically interested in coastal tourism destinations in Maine. Maine's coastal landscapes and ocean-side communities play an important role in attracting visitors to the state (Maine Office of Tourism, 2019), but coastal tourism destinations are among the most vulnerable to climate change impacts (UNWTO, 2016). Maine coastal areas face a range of climate change impacts, including sea level rise, increased frequency of extreme weather events (e.g., hurricanes, intense rain events, storm surges), increased temperatures, changes in seasonality, and rapidly rising ocean temperatures and the resulting impacts on ocean ecosystems (Fernandez et al., 2020; Horton et al., 2014). These climate change impacts have the potential to positively and negatively impact Maine's tourism economy. Studying how stakeholders in these coastal destinations are preparing for and reacting

to climate change is important for understanding the long-term resilience of Maine's tourism industry (Moreno & Becken, 2009).

1.4 Paradigm and Researcher as Instrument

For this research, I situate myself within the pragmatist paradigm as I utilize qualitative and quantitative approaches through mixed methodologies to understand what factors determine perceptions of climate change and how, if at all, those perceptions might influence behavioral responses to climate impacts. This pragmatist orientation seems fitting given my initial undergraduate background in predominantly quantitative biophysical conservation research and my newer understanding of qualitative social science research in natural resource management as a M.S. student. Pragmatism is perhaps the most flexible paradigm as it is goal-oriented and focuses on what works to achieve research objectives (Feilzer, 2010; Maxcy, 2003). Pragmatism seeks answers to the question, "What is the nature of human experience?" (Maxcy, 2003; Morgan, 2014). Pragmatic inquiries are concerned with knowledge, especially as it relates to action, not only in the present but also what might be in the future (Goldkuhl, 2012; Maxcy, 2003). The nature of my research questions revolves around understanding how participants know their world and how that might shape their behavior, further exemplifying a pragmatist approach to a phenomenon. I believe that knowledge and perceptions influence behaviors, though barriers and facilitators play an important role in allowing these two things to be congruent.

As discussed by Guba and Lincoln, paradigms, or philosophical stances, have an ontology, epistemology, axiology, and methodology (Guba & Lincoln, 2005). Ontology refers to the nature of reality and ranges on a spectrum. Positivists, on one end of the paradigm spectrum, argue that there is one reality that can be measured with the right methods (Guba & Lincoln,

2005). In contrast, constructivists, at the other end of the paradigm spectrum, argue that there are multiple realities and participants construct their own subjective realities; therefore, reality is relative to each participant (Guba & Lincoln, 2005). Pragmatists following Dewey would argue that reality is both subjective and objective, that reality is constrained by the nature of the world but also limited to our interpretation of the world through our experiences (Maxcy, 2003; Morgan, 2014). Closely related to ontology is epistemology, how we understand and value knowledge, and this concept too is on a spectrum from objective to subjective. Objectivism is often associated with positivism and postpositivism, and objectivists believe that knowledge exists whether or not we are conscious of it and that there is absolute knowledge (one truth/reality) that researchers seek to explain (Guba & Lincoln, 2005). In contrast, constructivism is on the opposite end of the spectrum arguing that knowledge is socially constructed by individuals interacting with one another and their world (Guba & Lincoln, 2005). Epistemologically, Dewey argues that knowledge is socially constructed, inherently shaping our beliefs and therefore our experiences in an iterative cycle (Morgan, 2014). As Morgan (2014) describes, "the origins of our beliefs arise from our prior actions and the outcomes of our actions are found in our beliefs. Experiences create meaning by bringing beliefs and actions in contact with each other" (p. 1046). In relation to pragmatism, ontology, and epistemology, it is important to note that pragmatists are more concerned with getting useful, actionable answers to practical questions rather than debating the metaphysics involved in typical paradigm debates (Morgan, 2014; Patton, 2015).

Axiology and methodology are the remaining two components of a paradigm. Axiology examines the researcher's values and ethics through the research process. What is the goal of the research and what does the researcher value? In positivist and postpositivist studies, explanatory

knowledge about the world is intrinsically valuable, while critical theory and constructivist studies believe that propositional knowledge is valued as a means for emancipation (e.g., emphasizes participation and action of study individuals as co-researchers rather than study subjects). Pragmatism searches for "actionable findings" (Patton, 2015), placing my axiology closer to critical theory and constructivism. Methodologically, pragmatism is often associated with mixed methods research, but the methods do not determine the paradigm (Teddlie & Tashakkori, 2012). In determining what methods are appropriate for pragmatic studies, ask yourself, "What difference would it make to act one way or another?" meaning that you have to understand what outcomes or outputs you are seeking and then decide how best to reach those outcomes methodologically (Patton, 2015). Positivists and postpositivists typically use experimental methods, test hypotheses, or try to predict or explain phenomena. Constructivists gravitate toward hermeneutical or dialectical methodologies, meaning more holistic methods that consider written, verbal, and non-verbal communication between the researcher and participants as forms of data (Guba & Lincoln, 2005). Pragmatists use qualitative and quantitative methods to accomplish their research goals, as I have done in this dissertation. Employing both qualitative and quantitative methods gives me the most comprehensive, complete understanding of a phenomenon, which could not be achieved without the use of mixed methods (Feilzer, 2010).

Pragmatists believe that inquiry is a form of experience rooted in contextual, emotional, and social perceptions and experiences (Greene & Caracelli, 2003; Morgan, 2014). As a pragmatic researcher, it is crucial to pay attention to how these contextual factors influence my choices and the ways in which I interpret the outcomes of participant choices. While other paradigms start by defining their ontologies and epistemologies, pragmatists prefer to start by addressing the following question: "What is the nature of human experience?" (Morgan, 2014).

Pragmatism thus pairs well with my approach that asks questions to understand the experiences of tourism stakeholders in coastal Maine destinations dealing with climate change while also seeking to understand visitor perceptions and behavioral intentions. Mixed methods are often associated with pragmatism as this paradigm invites diverse ways of thinking, knowing, and valuing to study a phenomenon (Greene & Caracelli, 2003). By thinking creatively about the *way* we do research and potential outputs, pragmatists have the ability to break with conventional paradigmatic thinking and add credibility to an emerging paradigm, though some might criticize pragmatism for its lack of involvement in the paradigm debate. The purpose of this research is to understand the lived experiences of participants and the context that shapes those experiences. The use of pragmatism allows me to frame the complexity of this study and accomplish my research goals using a variety of qualitative and quantitative methods that might be at odds in other paradigmatic approaches (Greene & Caracelli, 2003; Teddlie & Tashakkori, 2012).

1.4.1 Researcher-As-Instrument

In qualitative studies, the researcher is the instrument through which data is collected and interpreted. Because of this, I believe that readers should know my identity as a researcher and my interest in the topic. I was born and have lived in Maine for my entire life, and as such, feel a deep connection and sense of place to many parts of the state, including coastal Maine. I have summited every peak in Acadia National Park, whether on my own two feet or as a baby in a backpack carrier with my parents. Though I had not spent much time in Machias before this project, I was immediately at home in this small, quintessential Maine community facing the challenges of being highly dependent on natural resources (e.g., tourism, fishing, forestry) that all seem to be under threat due to climate change.

While familiar with my study sites, I was still an outsider unaccustomed to coastal living. I am not a fisher, forester, or farmer, and these were often livelihood strategies taking place within or nearby my study sites. I therefore do not have the same ability to understand how tourism might be viewed as an alternative livelihood strategy, perhaps with the ability to degrade or replace more traditional industries. While I believe that tourism can be a tool for economic development and achieving a higher quality of life, I know there are many instances where tourism has resulted in environmental and social decline. Harm to the natural resource base, wealth disparities between tourism and non-tourism stakeholders, commercialization of culture, and higher instances of crime are all possible with tourism development, if not planned and managed properly.

I also believe that climate change is a scientifically documented anthropogenic change. Yet, I know that climate change can be viewed by others as an uncertain, overblown phenomenon or one that is not happening at all. There were certainly some challenges presenting this project to participants who did not believe in or were skeptical of climate change, but whose voices would be important to capture. I am also not a climate scientist and was largely unable to answer questions about the biogeochemical processes that create the greenhouse gas effect, to the disappointment of several participants. Admitting this ignorance was at times a useful way to ease potential concerns about my position as a researcher (often associated with some amount of power) and reinforced that I was there to learn from my participants, rather than being the one with the answers.

As a researcher, it was important to accept what participants said and interpret their meanings from their perspectives. This meant shelfing my own beliefs, to the extent that this is possible, while asking interview questions, talking to survey participants, and analyzing the data.

It was especially important to engage in the practice of bracketing during the qualitative data analysis phase to interpret what participants were saying precisely as their perspectives were given, regardless of my personal opinion (Giorgi, 1997). This process of bracketing lets the voices of my participants come through in the data analysis process. I ultimately view the participants in this study as the experts—no one knows more about their lives than they do! It is my position as a researcher to capture and document their experiences to look for patterns.

1.5 Organization of the Dissertation

Chapter 2 applies concepts from resilience thinking to understand how the nature-based tourism destination of Machias, Maine is addressing climate change. We used a phenomenological methodology to interview tourism suppliers (i.e., business owners, tourism planners, municipal workers, non-profits) to understand their lived experiences with climate change, their current and planned adaptations, and what factors related to community capacity contributed to climate change resilience. Chapter 3 examines the psychological and social factors that contribute to visitor climate change risk perceptions in Acadia National Park. Armed with a team of undergraduate and graduate research assistants, we used an on-site intercept survey with visitors. Data were analyzed using a hierarchical regression analysis to understand predictors of climate change risk perceptions. In chapter 4, we use a case study methodology that analyzes and interprets results from the visitor survey, interview data of nature-based tourism suppliers on Mount Desert Island, and archival evidence (i.e., newspaper articles, reports, scientific journal articles). We examine how studying tourism suppliers' and visitors' risk perceptions and behavioral responses can help us better understand destination resilience to climate change. Chapter 5 draws conclusions from all three chapters and reflects on climate change risk perceptions and destination resilience to advance our understanding of the linkages between the

two concepts. This dissertation provides important learnings on using resilience and risk perceptions theories to address a global phenomenon (i.e., climate change) that is experienced on a small scale, while understanding how local actors can respond to, anticipate, and adapt to uncertainty and change. By exploring the relationship between individual risk perceptions and destination resilience, we learn how the two concepts interact to help tourism stakeholders anticipate and respond to global change. Individual and community characteristics that increase tourism stakeholders' risk perceptions and destination resilience can potentially be applied to other natural resource management systems experiencing a range of shocks and stressors (e.g., climate change, COVID-19, economic recession).

CHAPTER 2: UNDERSTANDING COMMUNITY RESILIENCE TO CLIMATE CHANGE IN A RURAL NATURE-BASED TOURISM DESTINATION IN MAINE, U.S.A.

2.1 Chapter Summary

Coastal nature-based tourism destinations are especially at risk from climate change impacts due to their reliance on outdoor recreation assets. Community resilience is contingent on access to community capitals to foster empowerment and evoke a sense of agency. Yet, more information is needed on the key factors that enhance climate resilience in tourism destinations that have limited capitals. In this phenomenological study, we conducted semi-structured interviews with tourism stakeholders to understand factors influencing climate change resilience in the small, rural developing tourism destination of the Bay of Machias, Maine, U.S.A. Despite facing economic, infrastructure, and human capital challenges, the destination is taking action to adapt to their most pressing climate change threat, flooding, by engaging multiple stakeholder groups to leverage knowledge, skill sets, and social ties. These actions were enabled by social networks centered around shared values, beliefs, and sense of place, as well as engaged local governance, active knowledge sharing, and a sense of self-efficacy. Other rural coastal communities may be able to enhance their climate change resilience by leveraging resource sharing through collaboration and developing strong connections to place through livelihoods.

2.2 Introduction

The largest climate change threats to tourism destinations relate to loss of visitors through disappearing attractions, seasonal inaccessibility, or changes in visitor markets requiring different tourism structures and product offerings (Lew & Cheer, 2018). Some destinations, especially summer destinations in northern climates, may benefit from climate change as

warming temperatures increase their desirability (Fisichelli et al., 2015). Yet, preemptive climate adaptation planning is needed even in northern climates, particularly for coastal tourism destinations dependent on natural and outdoor recreation assets vulnerable to climate change impacts (Hestetune et al., 2018).

Resilient host communities develop individual and collective capacity to respond to and influence change, thereby countering vulnerability and risk (Jordan & Javernick-Will, 2012). By identifying vulnerabilities, building partnerships, and anticipating changes through the use of community resources, tourism destinations can absorb uncertain and unpredictable climate change impacts (Wyss, Luthe, & Abegg, 2014). Resilience can be built by increasing stakeholder access to resources and social adaptive capacity, which leads to effective behavioral responses and has implications for overall system resilience (Maclean, Cuthill, & Ross, 2014).

2.2.1 Community Resilience

Holling first defined resilience as the "persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables" (Holling, 1973, p. 14). This definition comes from an ecological perspective but has been more recently applied to social systems, expanding upon the definition to include adaptive capacity and learning (Gunderson, 2000). Holling himself began to differentiate social from ecological systems saying that social systems have foresight, communication, and technology (Holling, 2001). Resilience is now often considered the sum of three properties: (i) the amount of change the system can undergo while still remaining within a domain of attraction, (ii) the degree to which a system can self-organize, and (iii) the ability of the system to learn and adapt (Carpenter, Walker, Anderies, & Abel, 2001). The concepts of resilience and adaptive capacity are inherently linked. Adaptive capacity refers to the preconditions necessary to enable

adaptation and the ability to mobilize these elements (Adger et al., 2011), while the adaptive cycle refers to continuous, multiscalar cycles of disruption, reorganization, and renewal resulting from multiple interacting perturbations that determine system vulnerability (Chapin, Folke, & Kofinas, 2009; Gallopín, 2006). This cycle emphasizes the nature of change and uncertainty in resilience thinking, moving away from concepts of stasis and equilibrium. Using a socio-ecological systems approach, Gunderson and Holling (2002) describe how adaptive capacity is influenced by both a system's vulnerability and its resilience. Recently, scholars have suggested that community adaptive capacity can be conceptualized as a descriptive point on a spectrum of that community's vulnerability and resilience to climatic impacts (Jurjonas & Seekamp, 2018; Jurjonas, Seekamp, Rivers III, & Cutts, 2020). This conceptualization of a community's adaptive capacity enables the integration of community capitals that either heighten its vulnerability or enhance its resilience.

According to Magis, "community resilience is the existence, development, and engagement of community resources by community members to thrive in an environment characterized by change, uncertainty, unpredictability, and surprise" (Magis, 2010, p. 402). These community resources are often described as capitals or assets (Deason, 2018; Turner et al., 2003), and communities may actively build up their capitals, including social, human, cultural, built, political, financial, and natural, so that they can respond to disturbances, create innovative solutions, identify opportunities, and shape the trajectory of the community's future (Magis, 2010). Social capital is defined as resources embedded within individual or community social networks and is often described as the glue that ties individuals within a community together (Hopkins & Becken, 2014). This type of capital is a product of interactions between individuals determined by trust, norms, inequalities, social exclusion, and power differentials, and when a

group has a lot of social capital, these interactions form networks of collaboration and cooperation (Flora & Flora, 2013). Social capital is what expands an individual's concern beyond themselves to consider challenges and opportunities that affect a broader group of people, such as their community (Flora & Flora, 2013). Previous studies have found this type of capital to be a powerful source of resilience-building (Duke, Cottrell, & Cottrell, 2018; Magis, 2010).

Human capital refers to health, skills, knowledge, and labor potential, as well as leadership and the ability of leaders to be proactive in addressing community needs (Stern, 2018). Cultural capital is reflected in values, beliefs, and ways of knowing the world and behaving, contributing to collective identities (Flora & Flora, 2013). Built capital, sometimes referred to as physical capital, describes community infrastructure, such as roads, buildings, and telecommunications, and tourism superstructure (DFID, 1999). Developing infrastructure is often the focus of rural communities that tend to be underbuilt (Flora & Flora, 2013), especially in tourism destinations that serve as service hubs. Ensuring access to adequate infrastructure is important for rural communities that are often under-built; however, sometimes increasing built capital overshadows other important community capitals, such as social capital, and access to built capital across different groups of people is often uneven (Flora & Flora, 2013). Political capital includes the organizations, connections, voice, and power of communities as they codify norms and values into enforceable rules and regulations that determine the distribution of resources (Stern, 2018). While financial capital is often simplified to wealth and financial assets (income, real estate, stocks, pensions, etc.), it also includes how money is invested in capacity building for current or future livelihood projects that support economic development (Pigg et al., 2013). Finally, natural capital refers to the lands, environmental resources, and ecosystem

services that provide the raw resources upon which all other capitals depend (Stern, 2018). A resilient community is one that finds the "right" balance of capitals, rather than having an excessive amount of one capital to make up for a lack of another capital (DFID, 2000; Kline, Mcgehee, & Delconte, 2019).

2.2.2 Tourism Destinations and Climate Resilience

Tourism destinations include access, gateways, attractions, one or more communities, and the linkages between attractions and the communities (Gunn & Var, 2002). Within tourism destinations, communities are essential as they provide access points (i.e., transportation hubs), support services (e.g., restaurants, water supply, gas stations, telecommunications, etc.), and often contain attractions, all of which support and link residents of the community and tourists visiting the destination (Gunn & Var, 2002). Within nature-based tourism destinations, natural features are the primary attraction. Due to this reliance on natural features, nature-based tourism destinations are especially sensitive to climate change (Bitsura-Meszaros et al., 2015). Winter, mountain, and coastal tourism destinations are at increased risk to climate change (UNWTO, 2016). A recent study suggests that the tourism industry is more vulnerable than resilient to climate change even though the effects of climate change on tourism have not yet been fully measured (Dogru, Marchio, Bulut, & Suess, 2019). Climate change will impact tourism demand, seasonality, and destination appeal, which are expected to shift under projections of future climate change scenarios (Amelung et al., 2007; Gössling et al., 2012; Smith, Brownlee, & Seekamp, 2018). In some cases, perceptions of climate conditions or environmental changes are just as important to consumer choices as the actual conditions (Huebner, 2012). While individual adaptation behaviors can reduce host and visitor risk perceptions, without larger scale, collective

adaptation strategies, individual tourism business adaptations are likely to remain at high risk from climate impacts.

Many tourism destinations are communities, or regions with a series of communities providing the tourism services and attractions. Hence, the concept of community resilience can be applied to understand the social, institutional, and economic resources that increase socio-ecological system resilience within tourism destinations. A community level research approach to destinations allowed us to identify and study various groups of people within their own context that make tourism possible in a rural setting. Given that resilience can look different across communities, we must develop an understanding of factors relating to resilience grounded in the context of the communities in which we study (Chapman, Trott, Silka, Lickel, & Clayton, 2017).

Community capacity (Fischer & Mckee, 2017; Magis, 2010) and agency (Chapin et al., 2009) are necessary for communities to respond to changing, uncertain conditions such as a shocks, stressors, or opportunities (Berkes & Ross, 2013). We therefore conceptualize resilience as both having community assets and strategically using them to respond to changes. Drawing from a review of the psychological development and mental health literature on community resilience, Berkes and Ross (2013) have developed a framework of attributes that contribute to community resilience. The authors describe community resilience as being comprised of *(a)* people–place connections, *(b)* values and beliefs, *(c)* knowledge, skills and learning, *(d)* social networks, *(e)* engaged governance systems, *(f)* a diverse and innovative economy, *(g)* community infrastructure, *(h)* leadership, and *(i)* a positive outlook and readiness to accept change (Berkes & Ross, 2013).

Place-based relationships often contribute to community resilience and are closely associated with lifestyle values through strong emotional bonds to a specific location or setting that influence attitudes and behaviors within place (Davenport & Anderson, 2006). These values and beliefs, in combination with social capital, community networks, and shared social identity have contributed to community resilience in previous literature (Berkes & Ross, 2013). Knowledge, skills, and learning influence a community's ability to respond to local problems through the use of information sharing and partnerships, technology and innovation, and skill development—such as financial, communication, and technical skills (Maclean et al., 2014). Adaptive governance adopts flexible management agendas but also refers to the processes of collaboration and cooperation across varying levels of authority (e.g., government agencies, nongovernmental organizations, individuals, etc.) (Cosens, 2013; Lebel et al., 2006). Communities require leadership among individuals and/or community groups to bring together diverse perspectives and facilitate decision-making and collective action (Magis, 2010). A positive outlook and ability to accept change often manifest as feelings of hope, optimism, empowerment, and self-efficacy, or one's ability to influence change (Maclean et al., 2014; Milfont, 2012), the lack of which can pose challenges, especially in relation to climate change adaptation. Together these factors influence a community's agency and self-organization, ultimately shaping their resilience to shocks and stressors.

While resilience thinking continues to grow in popularity, more research is needed to better understand the concept of resilience as it relates to social systems, especially at different scales (such as individual, household, and community) (Davidson, 2010). Further conceptual development of community resilience is called for due to the nested, interactive nature of resilience across scales as described by panarchy (Holling, 2001). Despite the conceptual overlap

between communities and tourism destinations as a unit of analysis, resilience thinking has only recently been applied to tourism research (Hopkins & Becken, 2014). By studying the factors contributing to community resilience outlined by Berkes and Ross (2013) in a community reliant on nature-based tourism in rural Maine, we add to work incorporating resilience theory within tourism studies. The goal of this study was to gain an in-depth understanding of the range of tourism industry stakeholder (i.e., hotels, restaurants, planners, land managers, non-profits) perceptions and experiences related to climate change, to understand what adaptation strategies are being employed in the face of climate change, and to determine what community assets enabled deploying strategies to enhance resilience in tourism dependent communities. We examined how a small, rural community in coastal Maine with relatively low socio-economic status and a conservative political outlook is deploying what resources they have to increase their resilience to climate change.

2.3 Methods

2.3.1 Study Site

The Bay of Machias destination includes Machias and the surrounding communities of Machiasport, East Machias, Whitneyville, Marshfield, and Roque Bluffs (Figure 4). The Bay of Machias is located to the north of Mount Desert Island and Acadia National Park and is connected via coastal Route 1 highway. Comprised of quintessential, quiet New England towns, the Bay of Machias is home to approximately 5,500 residents, with just under 2,000 living within the town of Machias (US Census Bureau, 2010). Unlike other coastal tourism destinations in Maine, area residents live here year-round, and the economy is reliant on wild blueberry harvesting, fisheries, and nature-based tourism. The average household income for Bay of Machias residents was $30,093 in 2016, well below the average income of $53,079 for all Maine

residents (City Data, 2018). This area suffers from a higher rate of poverty, with 29.1% of residents living below the poverty line, as compared to 12.9% statewide (City Data, 2018). The town of Machias is also home to the University of Maine Machias which is involved in several community-based outreach projects, including assessing the physical vulnerability of area infrastructure to rising sea level and flooding due to climate change.

Key tourist attractions are located in the surrounding communities and include several protected areas, such as Moosehorn National Wildlife Refuge, Cobscook Bay and Roque Bluffs State Parks, public lands, and many conserved lands protected by land trusts. Other attractions include marine tours to view the charismatic, threatened, and endemic Atlantic puffin, historical sites, fishing culture, recreational water activities, leaf peeping during fall foliage season, and culinary tours. The town of Machias serves as the major gateway to the destination as it contains the highest number of attractions and support services, as well as the local Chamber of Commerce, which serves as a key information center for the area. This important central tourism hub was formerly a logging center and is located along the Bay of Machias on low-lying land.

The Bay of Machias is expected to experience a range of climate change impacts as average annual temperature continues to increase (Fernandez et al., 2020). Summers are predicted to be longer with more precipitation, while Maine winters are becoming shorter with a decrease in snowfall (Fernandez et al., 2020). In addition to changes in climate conditions, scientists are also observing rising sea levels, ocean acidification, rising ocean temperatures, species and ecozone shifts, changing fisheries, disappearing salt marshes, beach erosion, and increased flooding events (Birkel & Mayewski, 2018; Horton et al., 2014), which are likely to impact the tourism industry, especially low lying coastal destinations like the Bay of Machias. For example, since 1912, the local sea level in Portland, Maine rose approximately seven inches

(about 18 cm) (Birkel & Mayewski, 2018). Portland is about 150miles southwest of Machias and has also experienced recent challenges with flooding.

2.3.2 Methodology

We used a phenomenological methodology to understand our participants' lived experiences and their subjective understandings of those experiences (Eberle, 2014; Moustakas, 2014). Phenomenology studies individual experiences because behaviors are determined by the phenomena being experienced rather than an objective reality external to an individual (Sloan & Bowe, 2014). By using this methodology we can understand the "essence" of being a nature-based tourism stakeholder in a coastal tourism destination experiencing and reacting to the effects of climate change (Sloan & Bowe, 2014). Phenomenology assumes that individuals are the vehicle through which the essence of a phenomenon can be accessed and described and that researchers can access that essence through interviews or written descriptions (Giorgi, Giorgi, & Morley, 2017; Priest, 2002).

2.3.3 Data Generation Methods, Participant Selection, and Gaining Rapport

For this study, we conducted semi-structured interviews to understand participants' experiences. We targeted nature-based tourism stakeholders working in the Bay of Machias, which included the central community of Machias and five adjacent communities. Interviewees included: nature-based tourism business owners (6), staff from non-profit organizations whose mission aligns to support tourism in some manner (8), a local municipal official (1), and researchers whose work overlaps with the content of this project (2) (see Table 1 for participant demographics; pseudonyms were used to protect participant privacy). The number of interviews (n = 17) was determined by saturation, the point at which no new data emerged at the study site (Patton, 2015).

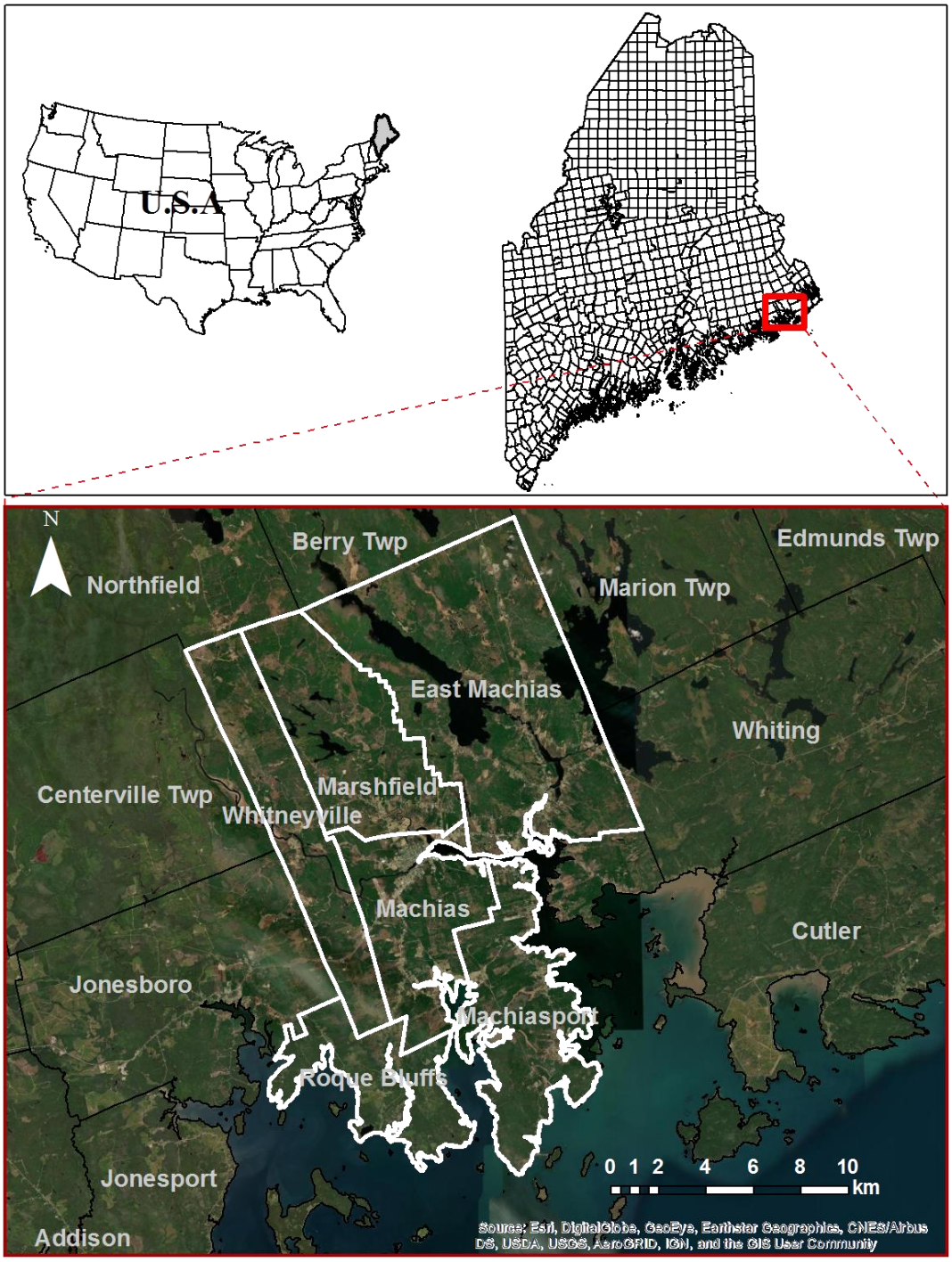

Figure 4. Bay of Machias study site.

We generated an initial list of potential interviewees that included voices from different types of stakeholders; participants were further selected using chain referral whereby participants

recommend other potential participants (Patton, 2015). The small size of the tourism destination and word of mouth about the project allowed us to gain entry with destination planners and managers (already a close-knit group that work together frequently). Presenting the project to an audience of potential participants at a regional meeting, the Downeast & Acadia 4th Annual Tourism Symposium held in November of 2018 in Machias, at the start of the project helped build rapport with stakeholders. Additionally, executing and sharing research results on a small visitor survey conducted in the area was another way to maintain trust, as this survey was the first to relay visitor statistics specific to the Bay of Machias destination.

We used semi-structured interviews to understand (1) belief about and knowledge of climate change, (2) experiences with climatic changes, (3) challenges and opportunities to their organization/business posed by these changes, (4) peer awareness and concern regarding climate change, and (5) planned and in place climate change adaptation and mitigation strategies (see Appendix A for interview protocol). We used probes where further clarification or elaboration was needed (Flick, 1998). Interviews were recorded and transcribed verbatim to be as close to participant's meanings as possible (Giorgi et al., 2017). Interviews were typically 60-90 minutes in length. Interviews were conducted face-to-face (10) and via phone (7). All interviews were recorded with the permission of the participant and the researcher jotted notes during the interview. Data were stored and analyzed in NVivo 11 Pro ©.

Table 1. Participant descriptive information.

Pseudonym	Role
Ethan	Non-profit
Molly	Non-profit
Dianne	Municipal
Nancy	Researcher
Greg	Non-profit
Tony	Non-profit
Mary	Non-profit
Beth	Non-profit
Patrick	Nature-based tourism business owner
Seth	Researcher
Kathy	Hospitality business owner
Emily	Nature-based tourism business owner
Raymond	Nature-based tourism business owner
Kayla	Hospitality business owner
Dylan	Nature-based tourism business owner
Alan	Non-profit
Theresa	Non-profit

2.3.4 Analysis

We used interpretive phenomenological analysis (IPA) to explore interview transcripts, using an iterative process of constructing themes and sub-themes from the data (Giorgi, 1997). We began analysis by reading through each transcript in full before coding, allowing us to grasp the description as a whole (Giorgi, Giorgi, & Morley, 2017). Researchers bracketed previously held knowledge regarding the phenomenon to ensure that we considered "what is given precisely as it is given" by participants (Moustakas, 1994). Bracketing is sometimes referred to as *epoché*, a process where the researcher sets aside any attitudes that are not phenomenological in nature (i.e., positivist or post-positivist, objective) (Giorgi, Giorgi, & Morley, 2017). First cycle coding identified patterns that emerged using in vivo codes to stay close to participant's words (Miles, Huberman, & Saldaña, 2020), which we later clustered into pattern codes where participant ideas were connected to meaning units (Giorgi, Giorgi, & Morley, 2017). Using phenomenological

reduction, these preliminary in vivo codes were condensed into descriptive nodes, a process sometimes referred to as horizontalization (Giorgi, 1997; Miles et al., 2020). Through an iterative coding process, we used multiple rounds of coding, concept maps, quotations, and memoing to draw conclusions and understand the texture and structure of participants' lived experiences (De Urioste-Stone, McLaughlin, Daigle, & Fefer, 2018; Moustakas, 2014). As a final cycle of IPA, and using the phenomenological reductive approach to data analysis, we aggregated the meaning units (codes) into themes to understand the meanings behind participants' experiences of a phenomenon, moving beyond description to include interpretation (Giorgi, Giorgi, & Morley, 2017; Sloan & Bowe, 2014).

2.3.5 Ethical Consideration and Ensuring Trustworthiness

Participation in this study was voluntary, consensual, and confidential, aiming to minimize risk to participants (see Appendix C for IRB approval). To ensure trustworthiness, we kept reflective journals to enhance credibility, dependability, confirmability, and transferability (Patton, 2015). Additional steps to ensure credibility included open-ended interview questions, acknowledging the role of the researcher as the instrument of data generation, and triangulation across multiple participants (Patton, 2015). We used an audit trail including personal memos reflecting on the study process and data analysis to acknowledge the impact we had on the study, holding us accountable to personal biases (Creswell, 2013). Multiple readings of interview transcripts and peer debriefing also enhanced the credibility of the conclusions (Miles, Huberman, & Saldaña, 2020). Using NVivo 11 Pro© to create a database enhanced dependability and confirmability of the study (De Urioste-Stone et al., 2018). We used peer debriefing, the act of sharing interpretations with researchers who were less directly involved in the study, to establish confirmability that the data and their interpretation were not "made up" by

the primary researcher (Creswell, 2013). Finally, using in-depth interviews with participants and detailed descriptions of the methods will enhance transferability of results (Miles, Huberman, & Saldaña, 2020).

2.4 Results and Discussion

Berkes and Ross (2013) argue that resilience is achieved by having the following community strengths: social networks; engaged governance; values and beliefs; knowledge, skills and learning; leadership; people-place relationships; a diverse and innovative economy; community infrastructure, and; positive outlook (see Table 2 for illustrative quotes for each category). We used this framework to organize and interpret the lived experiences of participants working within the Bay of Machias' tourism industry and found many of these elements present.

While many communities recognize the impacts of climate change, this knowledge does not necessarily translate into action (Hertwig & Frey, 2015). What, then, has catalyzed the Bay of Machias' collaborative adaptation initiative? In 2011, GROW Washington and Aroostook County began as a planning initiative in the Bay of Machias focused on job creation, modernizing infrastructure, and creating affordable housing for residents. Climate change was one of the focus strategies for this initiative, resulting in the creation of an online Geographic Information System (GIS) tool targeting regional planners to identify areas vulnerable to flooding under climate change scenarios (Johnson, 2020). Armed with this new knowledge, economic development planners expressed that they now have the technical capability to understand flooding as a major issue within their communities. This knowledge has culminated in the successful acquisition of a grant to explore seawall options in the low-lying Bay of Machias where the most damaging flooding is expected to occur.

2.4.1 Social Networks, Engaged Governance, and Leadership

Partnerships were important for participants. Participants mentioned working with different economic development agencies, tourism organizations, town offices, and the University of Maine Machias presently and for past projects. Working relationships were described in terms of information generating and knowledge sharing between groups and in terms of interpersonal relationships that formed the backbone of these collaborations. Strong interpersonal connections within and across communities enabled stakeholders to leverage their skillsets to accomplish more complex tasks than would be achievable if working alone. In previous studies, social capital is essential for community resilience (Kulig, Edge, Townshend, Lightfoot, & Reimer, 2013; Maclean et al., 2014; Magis, 2010). Matching the tasks that a community strives to undertake with their available capacities is critical for success (Fischer & Mckee, 2017). For participants, this meant a group of local leaders applying for funding to hire an environmental engineer to explore seawall options rather than trying to design a seawall themselves.

One non-profit participant described working with municipal officials and the relationship of mutual respect and trust that she has built through long-term engagement with these partners. Close relationships with municipal leaders are often unique to small towns that have a higher level of access to and involvement with officials compared to larger constituencies. That personal connection allows for continued support and partnerships that have led to funded community improvement projects. Due to the ease of access to municipal leaders, local knowledge can “trickle up” from community members. Community participation and collaboration in governance processes are associated with increased resilience and knowledge sharing across groups, and these processes are often associated with more effective outcomes

(Djalante, Holley, & Thomalla, 2011). Furthermore, coordination between governmental and nongovernmental organizations can promote resilience if both groups are held accountable (Lebel et al., 2006). Social ties, professional partnerships, and collaboration with government leaders allowed participants to engage with and learn from community members to work collectively toward goals.

Table 2. Illustrative quotes for the community resilience coding schema.

Category Name	Description of Category	Illustrative Quotes
Social networks	Networks of collaboration and cooperation	"It's a close-knit community." -Kathy "And the sense of community, everybody knows everybody and as much as a deterrent those low population numbers can be, sometimes that sense of community creates is invaluable. Let there be a disaster and everybody pulls out all the stops to help." - Molly
Engaged governance	Social and institutional structures and processes that engage citizens with decision-making processes	"[T]he flood resilience stuff is big. One of the great things about how [Machias is] doing [flood mitigation] is that it's incorporated, they're incorporating it into their long-term plans for rebuilding and improving their downtown." -Nancy "I know these municipal officials very well and they know me. And so when I need to, ya know, get support letters for a regional request [...] they were like 'Absolutely, I am right behind you, what do you need?'" -Beth
Leadership	Leadership among individuals and/or community groups to bring together diverse perspectives and facilitate decision-making and collective action	"The town was able to get the grant, look at the planning process of doing that. We don't have any money to actually construct it, but I think it's really forward thinking. The town revitalization committee brought up the issue to the selectmen and said that we really need to start looking at something." -Molly "We have an intricate, intricate state and federal system that supports [the lobster fishery management] but is largely managed by the community and has done an incredible job of stewarding the resource." -Greg
Values and beliefs	Shared beliefs, values, and ideas within a community	"It is tough because [the area] is very conservative and really low income, but they know what is going on in their hearts. They know what is going on, so we can work with that if we are smart about it." -Tony "We're pretty well supported. Our public, you know, perception is really strong. You know, people really, sort of believe in our mission and what we do." -Ethan

Table 2 Continued. Illustrative quotes for the community resilience coding schema.

Category Name	Description of Category	Illustrative Quotes
Knowledge, skills, and learning	Knowledge sharing, partnerships, technology and innovation, skill development, such as financial, communication, and technical skills; creation of new knowledge	"I have thirty-five years of experience as a professional and have learned a hell of a lot in the last decade, and I feel that it's time to, to try out some new management things." -Seth "We discovered that Machias downtown, most of the large employers are very, very vulnerable to storm surge and sea level rise related flooding. And they weren't aware of that before [the mapping work], and they were literally doing nothing about it." -Nancy
People-place relationships	Strong emotional bonds that influence attitudes and behaviors within a place; lifestyle values	"I hope that's a reversing trend, you know, that our best and our brightest aren't all going out, that some of them are going to stay here because the Machias area of Washington County is a unique place." -Kathy "[W]e have richness, and people, and their richness and values. It seems to be lacking in some other places...[W]e are not going to be the richest financially. So? […] We can be the richest when it comes to human values and I think that is really important." -Mary
Diverse and innovative economy	Ample economic opportunity; diversified livelihood activities	"We were dependent on fishing, lobstering, forestry, those are sort of the Maine, blueberries and agriculture and things. So those are kind of in the realm of to support your livelihood for the future." -Ethan "I said when I started this business, the one thing I learned was be diversified." –Patrick
Community infrastructure	Built infrastructure and tourism superstructure	"[M]ost bridges in Maine are at least a hundred years old. So the chances of getting that changed are probably little to none because [Maine Department of Transportation] can't afford to replace the ones that they need to replace, right. Never mind one that's functioning right. So we're probably 50 or 60 years out from seeing any chance of change." -Dianne "[A] lot of money is going to put into bring [infrastructure] up to a standard that can withstand this level of water rising. So those are resources that we are not able to put into other things as well." -Mary
Positive outlook	Ability to accept change often manifest as feelings of hope, optimism, empowerment, and self-efficacy	"I mean the opportunities are endless […] I think anything that I can dream can become an opportunity. I mean I can make my dreams happen." -Emily "I went to lots of selectmen's meetings and other meetings and everybody at these meetings always said, 'Oh, well we can't do that. We've never done that before.' Now I see a shift and it is a shift in optimism. First of all, they are not waiting for Augusta to come and help us but they are doing it themselves and they are making changes on their own, they are not waiting for someone to come in on a white horse and save us." –Molly

2.4.2 Belief in Climate Change and Conservation Values

Most participants (13/17) were aware that climate change was impacting their community, especially in connection to downtown flooding. Having experienced these events first-hand, in combination with knowledge about their causes through the flood maps, most participants were concerned about climate change impacting their communities (12/17). While many participants were thinking about climate change, not all felt that this was a pressing issue or that flooding was connected to climate change, indicating mixed levels of concern.

Several participants (7/17) described how communicating and planning for climate change is challenging in a traditionally conservative area. These participants described how their fellow community members are observing environmental changes but not connecting them to climate change. While climate change may continue to be a politically charged issue, participants described a shared valuation in natural resource conservation among residents in the study region. Resilient communities have shared value systems, mutual concerns, and therefore similar priorities (Kulig et al., 2013; Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008). Previous work finds that biocentric and altruistic values orientations are often associated with climate change belief, concern for environmental issues, and support for pro-environmental actions (Dietz, Dan, & Shwom, 2007; Ziegler, 2017). People usually act in accordance with their values (Heberlein, 2012). Shared concern about climate change and valuation of the local environment among participants are likely contributing to climate change adaptation initiatives, even where political divides may exist. These climate actions may need to be described to the public as steps toward conservation rather than climate change adaptation to appeal to shared community conservation values.

2.4.3 Knowledge, Skills, and Learning

The University of Maine Machias is propelling climate change conversations among local leaders and planners. Through the online participatory GIS mapping tool, planners can understand future flood projections for the Bay of Machias, connecting their first-hand experiences with flooding to local data. These maps became a learning tool across the community and serve as a boundary object, something that enhances the capacity of ideas, knowledge, theories, or practices across different user groups (Fox, 2011). Maps can be especially useful boundary objects as they can create common understanding from which people can build upon (McGreavy, Hutchins, Smith, Lindenfeld, & Silka, 2013). This appears to be the case for several participants (who became the exploratory seawall grant leadership team) who learned of the flood risks through the participatory mapping tool. This group then leveraged their existing skills (i.e., community planning, grant writing, and partnerships) and localized knowledge to apply for a seawall exploration grant. The concept of resilience also acts as a boundary concept in this instance (Fox, 2011). Participants framed their seawall grant using the concept of community resilience and when speaking about their efforts toward climate change planning and adaptation.

Apart from the flood maps, participants relied on traveling guest speakers brought in via the University of Maine Machias and other local organizations, direct contact with scientists, scientific reports, and their own observations to understand climate change. In addition to having a university in the area, non-profits are also key actors in providing educational speakers, resources (e.g., newsletters, reports), and connections to larger national knowledge networks. At least three non-profit interviewees offered educational programming. While simply being provided with climate change information does not necessarily increase levels of concern (Kahan

et al., 2012; McComas, 2006), trust in the organizations communicating scientific information can increase perceived risks (Salmon, Byrne, & Fernandez, 2013). Previous studies have found that first-hand experience with climate change impacts increased intention to act (Horne, De Urioste-Stone, & Daigle, *in prep*.; van der Linden, 2015). It is likely that the trust established between non-profits and Bay of Machias participants and first-hand experience with climate impacts were both important factors in increasing awareness and concern for local climate impacts.

2.4.4 People-Place Relationships

The Bay of Machias has a strong sense of place and community among residents created by close relationships with the environment. This relationship with the environment is illustrated by the intricate connection to lobsters and fishing, resulting in long-term stewardship practices. While certainly not all individual action reinforces sustainable resource use, participants agreed that a strong connection to the natural resource base resulted in a largely shared environmental ethos throughout the region. Four participants described challenges in keeping youth in the region due to limited job opportunities; however, this trend may be slowing as more graduating students choose to stay in the region. While low population numbers were described as a challenge, the positive side to that situation was the creation of a strong sense of community, which was seen as an important asset by many participants (13/17). This strong sense of place and unfailing sense of community helped nonprofits and other organizations continue to function through donations and other forms of support, such as event attendance and fundraising. Previous studies have found people-place relationships to be a key element in motivating and sustaining community resilience efforts when resources, skills, and experience to implement changes are also present (McElduff & Ritchie, 2018). Similarly, a study of two coastal

communities in Northern Norway found that the emotional connection a community has with a place was the primary driver of climate change adaptation behavior (Amundsen, 2015). Community motivation and buy-in for adaptation projects appears to be present, at least when strategic communication strategies are used on the part of local leaders, due to this deep connection people feel with the environment and community.

Due to the economic reliance on natural assets and the environmental ethos shared by many rural Maine communities, attachment to place seems to be a motivating factor in adapting to climate change. While place attachment can be change-oriented, focusing on community improvement and adaptation to external changes, place attachment can also be stability-oriented, focusing on protection, nostalgia, and fear of loss (Zwiers, Markantoni, & Strijker, 2016). Place attachment can encourage communities to revitalize an area and protect the environment by drawing upon their sense of rootedness, place dependency, and identity (Kulig et al., 2013; Zwiers et al., 2016). Conversely, place attachment stemming from a stability orientation may cause communities to resist change, which could create negative community resilience, such as a poverty trap (Cavaye, Ross, & Cavaye, 2019). Change and stability place attachment orientations lend themselves to the environmental ethos of Machias participants and their willingness to protect natural assets. A change place attachment orientation can lead stakeholders to alter aspects of their community they are unhappy with (e.g., increased flooding) while a stability place attachment orientation can cause stakeholders to protect positive aspects of their community (e.g., the downtown area, industrial heritage) (Zwiers et al., 2016). The desire to protect the community in which participants live extends to the social connections within this small community and a desire to preserve their traditional way of life. For example, the seawall initiative focuses on flood alleviation while seeking to revitalize the downtown area and preserve

cultural and historical assets associated with the Bay of Machias' proud history as a working waterfront.

2.4.5 Diverse and Innovative Economy

Economic development and diversification are central to many Bay of Machias agencies. Participants acknowledged a lack of economic opportunities, which resulted in emigration of locals to areas with more job opportunities. Though once home to a bustling harbor for timber shipments, the mills have since closed, resulting in the need for economic shifts in livelihood activities. Fishing remains strong, though participants raised concerns about the impact of climate change on lobster. The closing of nearby canneries was another economic blow for the area. With the loss of some traditional industries, the Bay of Machias began further developing nature-based tourism opportunities. The destination has numerous economic development agencies tasked with furthering livelihood options in the region, including tourism expansion. Though development initiatives are ongoing, the area remains economically underdeveloped.

Despite these challenges to economic development, a handful of participants (5/17) talked about how increasing tourism is an opportunity. Specifically mentioned was an individual who transitioned from fishing to guided wildlife boat tours, a hugely successful nature-based tourism venture. Tourism, especially nature-based and ecotourism, is often presented as an alternative livelihood activity in areas where there is little development and lots of natural capital (Sharpley, 2002). Livelihood diversification contributes to resilience at the individual, household, and community level such that if one livelihood activity collapses, others ensure access to financial capital (Jurjonas & Seekamp, 2018; Su, Wall, & Kejian, 2016). Those who embraced tourism in the Bay of Machias often deployed multiple livelihood strategies, such as tourism and fishing. Local attitudes toward tourism and livelihood shifts are often reflective of

the perceived costs and benefits of such a transition (Wu & Pearce, 2014). Even with tourism success stories, some locals remain skeptical of nature-based tourism as a livelihood option. This hesitancy toward tourism development could be explained by several comments on the perceived low quality of tourism jobs (e.g., low paying and servile in nature) or perceived competition with traditional livelihood activities (Mbaiwa, 2011; Saufi, Brien, & Wilkins, 2014; Tao & Wall, 2009). As one participant described, "perceptions of people in the community of tourism as a viable industry and important industry are a little low" (Mary, nonprofit).

2.4.6 Community Infrastructure

Participants viewed community infrastructure as aged and underdeveloped. This was the most discussed weakness regarding tourism and economic development. Old and chronically underbuilt infrastructure, poor road conditions, a lack of transportation options, and the overall lack of infrastructure (especially in terms of housing stock for residents and bed base for tourism) were cited as major problems for the Bay of Machias. There is no public transportation and no car hire services such as Uber and Lyft. Road conditions are generally poor along Route 1, and there are few places safe for bicycling. Limited housing stock was a challenge for attracting long-term residents and tourists, as was limited internet access. Infrastructure problems were connected to financial concerns and the acknowledgement that towns did not have money to fix infrastructure concerns in a timely manner. One participant described how up-to-date infrastructure by state standards does not consider climate change impacts. She described how the town would have to wait several decades to improve a downtown bridge that often floods and is strewn with boulders after flood events. There was little town-level control over adapting infrastructure to cope with climate change. As participants described, financial resources are scarce and issues of poverty, food insecurity, opioids, and lack of healthcare are widespread;

therefore, allocating resources for flood resilient infrastructure is a huge burden for the area. While infrastructure is often indicative of the level of tourism development, destinations likely have different expectations and requirements of infrastructure depending on their position in the Tourism Area Life Cycle (TALC) model (Mandić, Mrnjavac, & Kordić, 2018) (see chapter 5 for more details on the TALC).

Stakeholders in the Bay of Machias are focusing their adaptation efforts on infrastructure improvement with the seawall grant to increase built capital. Improving community infrastructure has the potential to "spiral up" to increase other forms of capital (Flora & Flora, 2013). For example, infrastructure projects in several small towns in North Carolina resulted in an increase in other forms of capital, especially human, social, and cultural capitals (Kline et al., 2019). In addition to contributing to built capital, it is likely that the seawall project is also increasing social and human capitals in the area.

2.4.7 Positive Outlook and Efficacy

Communities have only partial control over forces that affect them, and dealing with the uncertainty of climate change can be overwhelming (Gifford, 2011; Spence, Poortinga, & Pidgeon, 2012). Despite this daunting task, participants seemed optimistic about their ability to adapt to climate change impacts using a locally grounded approach that works with available resources (Jurjonas & Seekamp, 2018). There are a handful of proactive, highly engaged community members central to planning who are also interested in exploring tourism as a tool for community development. As one participant describes, instead of waiting for the state to resolve local problems, town and regional officials, planners, and managers feel as though they can explore climate change solutions that also address other local challenges, such as economic development and infrastructure maintenance. This empowerment has resulted in the exploration

of novel solutions and taking the initiative to build resilience into policies and programs without waiting for oversight from higher levels of government. This optimistic attitude is what brought together a small group of local experts that applied for the exploratory seawall grant, one of the first planning efforts in the area to explicitly focus on climate change adaptation.

Acting in the face of global climate change is an overwhelming task that can paralyze individuals. This paralysis can be explained by low perceptions of self-efficacy, or the belief that one's actions can make a difference, and can result in feelings of hopelessness (Milfont, 2012). Previous research indicates that people with access to climate change information can begin to think about its impacts, making risks more salient and potentially increasing demand for climate change action (Milfont, 2012). The interactive GIS maps provide flood projections at a local, rather than national, scale and increase feelings of self-efficacy. Self-efficacy also fits within a narrative describing Maine residents as self-sufficient and independent. Positive outlook and self-efficacy are related to ideas of collective efficacy and empowerment, which are often described as antecedents to decision-making and collective action (Kulig et al., 2013). The can-do attitude described by participants, stemming from feelings of empowerment and self-efficacy, creates a positive outlook for community planners that, once collectively organized, are leveraging their skills and resources to face of a problem larger than their community.

2.5 Limitations

Some interviews were conducted in the midst of the COVID-19 pandemic and this most certainly shaped tourism suppliers' perceptions. We also began a visitor survey in the Bay of Machias to understand demand side reactions to climate change but were unable to intercept a large sample. Visitor numbers to the Bay of Machias are small (and unknown given that Downeast & Acadia visitation surveys reflect the reality on MDI), and there are no high-density

sampling locations. We were therefore unable to assess visitor perceptions and likely behavioral responses to climate change impacts in the Bay of Machias. Understanding potential shifts in visitation would give us a more complete picture of how the Bay of Machias will be affected economically by climate change, providing a clearer picture of destination resilience. Working with a more locally based survey team and finding alternative methods beyond an intercept survey could help overcome sampling barriers in rural tourism destinations.

2.6 Conclusions

From this study we learn how a rural, nature-based tourism destination often characterized as being resource-poor can deploy its assets to build climate change resilience. While the challenges facing the Bay of Machias can be daunting, it would be inaccurate to assume that this destination is helpless to act. A closer look reveals how social, natural, human, and political assets can bolster a community's agency even when other capitals (e.g., financial and built) are lacking. While certain levels of capital are necessary, our study suggests that capitals relying on connections between people and between people and place can be a way for rural, traditionally resource poor communities to bolster climate change resilience. Being resilient to climate change will be different across destinations, with no "one size fits all" approach, especially as actions may reflect the stage of destination development. Similar tourism destinations should consider their strengths, available assets, and most pressing concerns when determining actions to build climate resilience. Maintaining long-term partnerships, adaptive learning, leveraging skills across individuals and organizations, and engaging locals with decision-making processes will be important as the Bay of Machias develops as a destination and continues to adapt to climate uncertainties. Furthermore, we suggest clear communication and

opportunities for public engagement in decision-making processes related to climate actions to build upon existing social networks, shared values, people-place relationships, and agency.

This study adds to the growing body of literature connecting tourism research with resilience concepts. By conceptualizing a small, rural tourism destination as a community, we were able to apply concepts from the literature on community resilience. Future research should focus on finding further ways to apply community resilience frameworks, such as the one used in this study from Berkes and Ross (2013), to different rural tourism destinations. The current study focused on a small, coastal nature-based tourism destination. It is unclear if concepts related to community resilience will work in larger rural tourism destinations or those facing different climate change impacts than a coastal destination. Future research might also consider the stage of destination development and its influence on available assets and pathways to climate resilience.

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CHAPTER 3: DETERMINANTS OF VISITOR CLIMATE CHANGE RISK PERCEPTIONS IN ACADIA NATIONAL PARK, MAINE, U.S.A.

3.1 Chapter Summary

Nature-based tourism is one of the most economically important industries in the state of Maine, U.S.A. Climate change impacts are projected to affect important tourism assets in Maine, which could result in behavioral shifts related to destination selection, seasonal visitation, and activity participation. Risk perceptions can be important predictors in visitor travel decisions. Recent tourism studies have focused on the effects of climate impacts on risk perceptions, but few have examined the social-psychological drivers of climate change risk perceptions. Drawing on social-psychological theories, we address this gap by understanding visitor climate change risk perceptions in Maine. We surveyed visitors to Acadia National Park in the summer of 2018 to assess the impact of socio-demographics, cognition, experience, and socio-cultural factors on visitor climate change risk perceptions. We used two-stage cluster probability sampling and intercepted 1,317 visitors on site; 480 participants completed the online follow-up survey. Using hierarchical regression, we explained 45.5% of the variance in visitors' climate change risk perceptions at a nature-based tourism destination. Visitors identifying as female, having higher levels of belief in climate change, more first-hand experience with climate impacts, and a higher altruistic values orientation reported amplified risk perceptions. Understanding determinants of climate change risk perceptions within an outdoor recreation setting has implications for offering high quality visitor experiences while maintaining the integrity of the natural resource base upon which visitation relies.

3.2 Introduction

The effects of climate change are already being felt in the tourism industry worldwide, with regional impacts requiring adaptation by stakeholders. Coastal, mountain, and winter tourism destinations are especially vulnerable to climate and weather impacts (UNEP, 2008). Climate change will affect tourism demand and seasonality in many destinations, which is expected to shift based on different climate change scenarios (Amelung et al., 2007; Gossling et al., 2012; Kanazawa, Wilson, & Holmberg, 2018; McCreary, Seekamp, Larson, Smith, & Davenport, 2019; Perry et al., 2018; Smith et al., 2016). Visitor experiences in protected areas, such as national parks, can influence climate change perceptions and may vary depending on the type of visitor experience (e.g., terrestrial versus marine environment) and visitor demographics (Brownlee, Hallo, Wright, Moore, & Powell, 2013; Brownlee, Hallo, & Krohn, 2013).

Risk perceptions of climate change can influence travel behaviors of tourists. For example, Huebner found a strong association between climate change risk perceptions and visitors' changes in travel behavior, such as destination selection, activities pursued, and spending (Huebner, 2012). Additionally, a recent study in Acadia National Park (ANP) found that visitors perceived the area to be vulnerable to climate change effects that are likely to impact the natural environment and infrastructure, particularly sea level rise, extreme weather, and disruption to island access (De Urioste-Stone, Le, Scaccia, & Wilkins, 2016). De Urioste-Stone et al. (2016) found that visitors concerned with changes that might put their personal well-being at risk were more likely to mention potential alterations in their future travel behavior.

The goal of this chapter is to examine what factors shape climate change risk perceptions of visitors to ANP. Climate change risk perceptions can be an important predictor of shifts in visitation to and in tourism destinations, though not all visitor segments will respond in the same

manner (Dawson, Havitz, & Scott, 2011; Pröbstl-Haider, Dabrowska, & Haider, 2016; Wilkins, De Urioste-Stone, Weiskittel, & Gabe, 2018). Understanding these shifts in visitation is crucial for tourism planners and managers to cope with the negative impacts of climate change on visitation while also helping stakeholders adapt and take advantage of emerging opportunities (Haegeli & Pröbstl-Haider, 2016). With more evidence of a changing climate, it is essential to understand how changes in climate trends may impact visitation so that tourism managers can adapt to these shifts while continuing to meet visitor expectations and resource management goals.

3.2.1 Risk Perceptions and Tourism

Risk has been defined as the, "things, forces, or circumstances that pose danger to people or to what they value," and risk is typically described in terms of a likelihood or probability of loss occurring (McComas, 2006, p. 215). This definition of risk led early analysts to undervalue the complex, subjective way that audiences internalize and interpret information, leading to an "all we have to do is tell them the numbers" mentality when communicating risk (Fischhoff, 1995). More recently, the field of risk perception and communication has focused on understanding the nature and antecedents of subjective risk assessments (Bodemer & Gaissmaier, 2015; Slovic, Finucane, Peters, & MacGregor, 2004). Climate change risk perceptions specifically refer to subjective evaluation of climate change as a hazard, threat, or phenomenon (Shakeela & Becken, 2015).

Understanding visitors' risk perceptions of climate change are especially important for nature-based tourism destinations and other areas that are sensitive to climate change impacts (Gössling et al., 2012). In relation to tourism, risk perceptions can be an important predictor of visitor behaviors, such as destination selection, seasonal visitation patterns (i.e., when tourists

choose to visit a destination), and the activities in which visitors choose to participate (De Urioste-Stone, Scaccia, & Howe-Poteet, 2015; Kanazawa et al., 2018; Karl, 2018; Perry et al., 2018). Conversely, some studies found that tourists' perceptions of climate change risks are unlikely to alter visitor travel decisions (Hestetune et al., 2018; Lise & Tol, 2002; Seekamp, Jurjonas, & Bitsura-Meszaros, 2019). Awareness of climate change can impact tourist behavior due to shifts in climatic appeal and the image of the destination (Atzori et al., 2018; Csete & Szécsi, 2015; Dillimono & Dickinson, 2015; Karl, 2018). In some cases, perceptions of climate conditions or environmental changes are just as important to consumer choices as the actual conditions (Huebner, 2012). It is therefore important to understand how tourists to climate sensitive destinations perceive their risk from climate change and what factors shape those risk perceptions.

3.2.2 Conceptual Foundations

Previous theories have described the influence of socio-demographics, cognition, experience, and socio-cultural factors on risk perceptions (Dunwoody & Griffin, 2015; Kasperson et al., 1988; van der Linden, 2015), and we focus on a combination of social and psychological predictors. In past studies, socio-demographic factors that influence risk perceptions include gender, political affiliation, and sometimes age. Identifying as female and being affiliated with a liberal political party often increases climate change risk perception (Safi, Smith, & Liu, 2012; van der Linden, 2015; Ziegler, 2017). A recent study conducted among visitors to Mount Desert Island (MDI) in Maine revealed that younger visitors (18-30 years of age) were more likely to believe that climate change will impact tourism in ANP compared to visitors older than 60 years (De Urioste-Stone et al., 2015), though other studies find age to be a non-significant predictor of risk perceptions (Safi et al., 2012; van der Linden, 2015).

Cognitive factors influence risk perceptions, including knowledge of climate change, belief in anthropogenic climate change, and perceived self-efficacy. Higher levels of climate change knowledge are often associated with higher levels of concern and perceived risk (Milfont, 2012; Pidgeon, 2012; van der Linden, 2015); however, Kellstedt's team found that knowledge was negatively associated with climate change risk perceptions (Kellstedt et al., 2008). A range of cognitive barriers prevent the public from understanding climate change. These include, but are not limited to, lacking knowledge on the cause and extent of climate change, environmental numbness (feeling emotionally indifferent due to the sheer size of the problem), uncertainty of impacts and appropriate actions and the relative benefits of such actions, perceived control (how capable people feel to act in a certain way), and optimism bias, the belief you will be less likely to experience negative events (Gifford, 2011; Horne, De Urioste-Stone, & Daigle, *in prep*; Slovic, 2007; Stern, 2018; Weinstein, 1989). Belief in anthropogenic climate change can also increase risk perceptions (Safi et al., 2012). Leiserowitz found that 62% of Americans believed climate change was caused mostly by human actions (Leiserowitz et al., 2020). Despite belief in climate change, it can often be perceived as something impacting geographically and temporally distant peoples, a phenomenon referred to as psychological distancing (Leiserowitz, 2005; Zwickle & Wilson, 2014).

Experiential processes include personal experiences and affect, and these factors shape risk perceptions. Experiencing an event that is the result of climate change first hand usually equates to higher risk perceptions, though there are challenges measuring experiences using self-reporting instruments and the attribution of impacts to climate change (Milfont, 2012; Pidgeon, 2012; Spence, Poortinga, & Pidgeon, 2012; van der Linden, 2014). The type of environmental impact may play an important role in determining risk perceptions as not all first-hand

experience with climate impacts result in higher risk perceptions. For example, winter tourism stakeholders in Western Maine who believed they experienced local climate change impacts were more likely to have higher risk perceptions than interview participants who did not feel they were experiencing climate change impacts (Horne, De Urioste-Stone, & Daigle, *in prep*). In contrast, Safi et al. (2012) found that drought in Nevada did not contribute to higher perceptions of risk among farmers and ranchers, possibly because drought is viewed as a natural occurrence in the area and was thus not cognitively linked to climate change. In another instance, experience with extreme storm and flooding increased risk perceptions in UK residents (Demski, Capstick, Pidgeon, Sposato, & Spence, 2017). The type of environmental impact may play an important role in determining risk perceptions and whether or not the event is perceived as natural. In addition to personal experiences with climate change, emotions can determine risk perceptions. Information processing is guided by affect and emotions and was the most important predictor of personal risk perceptions of climate change in van der Linden's study of social-psychological determinants of risk (2015). Affect incorporates morals and reason to form risk perceptions that could lead to mitigation actions through altruistic emotions (Roeser, 2012).

Values can also impact risk perceptions. Cultural frameworks shape risk perceptions at a societal level, while values shape risk perceptions on an individual level (van der Linden, 2015). A value is a "transsituational goal varying in importance, which serves as a guiding principle in the life of a person" (Schwarts, 1994). Values are relatively stable and related to the core of one's identity (Heberlein, 2012). Environmental values orientation have been traditionally divided into two dimensions, *(a)* openness to change versus conservatism and *(b)* social/self-transcendent versus egoistic/self-enhancement; however, more recent studies have distinguished three value orientations: biospheric, altruistic, and egoistic (DeGroot & Steg, 2007). Biocentric

and altruistic worldviews are often associated with higher concern for environmental issues, including climate change and support for ecofriendly action (Dietz et al., 2007; Stern, 2018; Wynveen & Sutton, 2015). For example, an analysis of US citizens found that environmental values played a significant role in climate change beliefs and attitudes (Ziegler, 2017). A recent study of UK citizens revealed altruism, not environmental values, and concern for poorer people suffering from climate impacts was a strong influence in adopting low carbon lifestyles (Howell, 2013).

3.2.3 Tourism and Climate Change in Maine

Tourism is one of Maine's most important industries, generating nearly 110,000 jobs (16% of employment in Maine) and $6.2 billion USD in revenue (Maine Office of Tourism, 2019). Tourism expenditures have increased in recent years, and spending associated with outdoor recreation is also increasing (Maine Office of Tourism, 2019). Almost half of overnight visitors to Maine engaged in some nature-based tourism activity, while 23% indicated that outdoor recreation was their primary reason for visiting the state (Maine Office of Tourism, 2019). Much of Maine's visitation is concentrated along the coast, with the highest numbers during summer months (Maine Office of Tourism, 2019). Maine is divided into eight tourism regions, with Downeast and Acadia, Mid-Coast, Greater Portland and Casco Bay, and the Maine Beaches covering the coastline. ANP is located in the Downeast and Acadia region. Visitation to Downeast and Acadia is increasing as 18% of 2018 visitors indicated that this region was their primary destination in Maine, an increase from 15% in 2017 (Maine Office of Tourism, 2019). The Downeast and Acadia region is tied with the Maine Highlands as the most popular destination for first-time visitors (Maine Office of Tourism, 2019). ANP is a key attraction within the Downeast and Acadia region, attracting 3.4 million visitors in 2019 (NPS, 2020b).

With a heavy economic reliance on outdoor recreation, Maine's nature-based tourism industry is, and will continue to be, altered by climate change. Since 1895, the average annual temperature in Maine has increased by 1.67° C and is expected to increase another 1.67-2.78° C by 2050. The summer season has increased by two weeks since the early 1900s and is likely to increase another two weeks by 2050 (Fernandez et al., 2020). Maine is expected to receive more precipitation in the form of rain, mainly in fall and summer, as a result of climate change (Fernandez et al., 2020). Additionally, rising sea levels, ocean acidification, rising ocean temperatures, species and ecozone shifts, changing fisheries, disappearing salt marshes, beach erosion, and increased flooding events are all impacting coastal destinations in the state (Birkel & Mayewski, 2018; Horton et al., 2014). Previous research indicates that a third of visitors to Maine will alter their plans in response to weather conditions, though visitors to ANP indicated they would not be deterred from visiting in spite of negative environmental changes due to high levels of place attachment (Wilkins & De Urioste-Stone, 2018; Wilkins et al., 2018b). This is consistent with a previous study predicting increased visitation to ANP under climate change conditions (Fisichelli et al., 2015).

3.2.4 Aim and Hypotheses

Our study aims to evaluate what factors determine ANP visitor climate change risk perceptions. Our hypotheses are as follows:

H.1. Female, younger, more politically liberal visitors will have higher risk perceptions than older, male, more politically conservative visitors.
H.2. Visitors with higher levels of climate change knowledge will have higher climate change risk perceptions than visitors with lower levels of knowledge.
H.3. Visitors who have more experience with climate change impacts will have higher risk perceptions than visitors with little experience with climate change impacts.
H.4. Visitors with higher biospheric values and higher altruistic values will perceive their risk from climate change as higher than visitors who have lower biospheric and altruistic values.

3.3 Methods

3.3.1 Study Site

Mount Desert Island (MDI) is the largest island off the coast of Maine with a year-round population of approximately 10,000 (Census, 2012). The location and extent of the study area are presented in Figure 5 and includes the towns of Mount Desert, Bar Harbor, Southwest Harbor, and Tremont. ANP is the main attraction on the island, attracting over 3.4 million visitors annually (NPS, 2020b). Visitors to ANP contributed $388 million to nearby gateway communities, supporting 5,600 jobs (NPS, 2019). Key attractions in ANP include scenic coastal and mountain views, nature-based recreational activities such as hiking, biking, boating, swimming, climbing, camping, and many cultural and historical attractions, such as the carriage roads, Park Loop Road, and Jordan Pond House. Though ANP is one of the National Park Service's smallest parks, it is ranked among the top 10 in visitor numbers (NPS, 2020a). The highest visitation occurs between May and October (NPS, 2020a). Due to the seasonal influx of tourists, MDI becomes very busy between May and October but remains relatively quiet during the winter months.

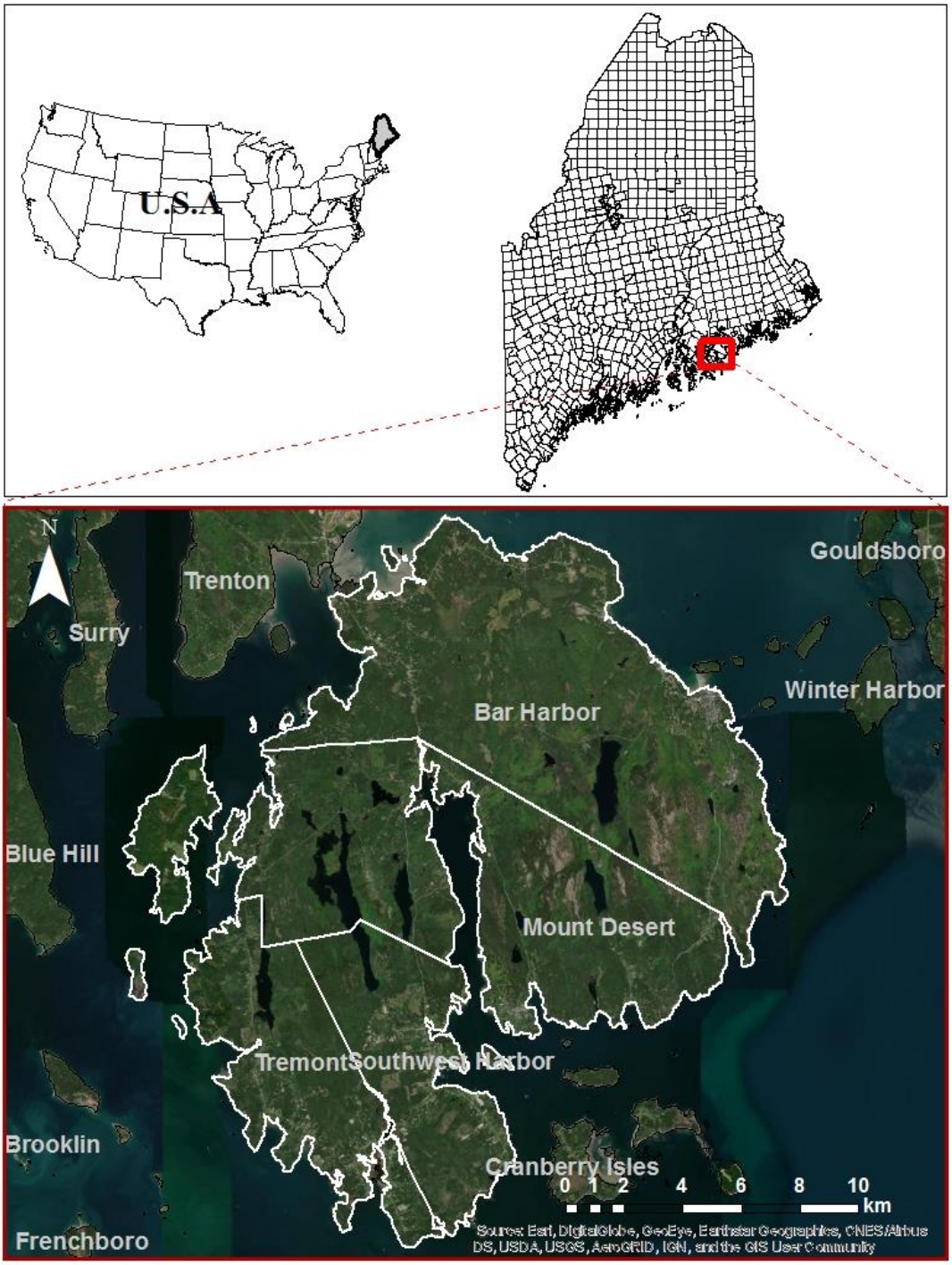

Figure 5. Acadia National Park located on Mount Desert Island.

3.3.2 Instrument Development, Sampling, and Data Collection

To identify factors contributing to tourist climate change risk perceptions, we used a two-stage probability cluster sampling strategy whereby survey dates were chosen at random, as were visitor groups, using interval sampling once on site (Scheaffer, Mendenhall, Ott, & Gerow, 2012; Wilkins et al., 2018b). Throughout the summer and early fall of 2018, we approached tourists at visitor centers, trail heads, and key outdoor recreation attractions within the study site asking them to participate in an online survey after their visit, while conducting a short intercept survey to help increase response rate (Dillman, Smyth, & Christian, 2014). Upon making contact with participants, we asked questions related to their travel behavior and then handed them a postcard with a more detailed project description and a link to the online follow-up survey (see Appendix D for survey instrument). We also asked participants for contact information so that we could send up to two follow-up postcards or e-mails to encourage survey participation (Dillman et al., 2014). To increase response rate, participants had the opportunity to enter themselves into a gift drawing at the end of the study (Dillman, Smyth & Christian, 2014). The online survey was completed by visitors after their trip to ANP and consisted of close-ended questions with previously tested scales that measured socio-demographics, cognitive factors, experiential processes, and socio-cultural factors to assess risk perceptions among tourists (van der Linden, 2015).

Scales were tested for reliability using Cronbach's alpha (see Table 3 for instrument description and Cronbach's alphas). All scales were recoded such that higher numbers corresponded to higher levels of agreement or higher threat levels. We used a principal components analysis to identify and compute composite scores for the constructs, with a varimax rotation and a threshold value of 0.05 (Hervé, 2003; Tabachnick & Fidell, 2013). We also

included a randomized experiment in the survey to test the effects of different message frames (health message, weather message, no message) on risk perceptions. The results of the messaging experiment are not reported on here, but we controlled for these experimental groups in the analysis.

3.3.3 Analysis Overview

We analyzed visitor survey responses in IBM SPSS Statistics 25. Descriptive statistics were generated for socio-demographic, cognitive, experiential, socio-cultural, and risk variables. We calculated response bias using Pearson's chi-square test to compare demographics, cognitive, experiential, and values between early respondents and later respondents from the online follow-up survey (De Urioste-Stone et al., 2016). We calculated total scores for all scales (for descriptive statistics, see Tables 4 and 5), winsorized univariate outliers with z-scores +/- 3.29 and transformed data that were skewed to meet the assumption of normality (Tabachnick & Fidell, 2013). Models were run with transformed (log transformation) and non-transformed variables and results were not significantly different; therefore, reported results use non-transformed variables for ease of interpretation. We used hierarchical regression analysis to determine the significance of independent variables and the variance in climate change risk perceptions explained by socio-demographics, cognitive, experiential, and socio-cultural independent variables.

Table 3. Instrument description including example questions for each construct, scale information, and Cronbach's alphas.

Construct	Sub-Construct	Selected Items	Items adapted from original studies	Minimum No. Items	Reliability Measure	Scale Type	No. Scale Items	Scale Range
Cognition	Belief in Climate Change	"On average around the earth, I believe the following are happening…" The temperature of the ocean is rising. The number of flooding events is increasing. Sea level is rising.	Brownlee et al., 2013	4	$\alpha = 0.95$	Continuous	6	Strongly agree-Strongly disagree; I don't know
Cognition	Actual Knowledge	Climate change is currently happening. Humans contribute to climate change. Carbon dioxide emissions contribute to climate change.	Van der Linden, 2015	3	$\alpha = 0.82$	Continuous	8	Strongly agree-Strongly disagree; I don't know
Cognition	Perceived Knowledge	Climate change is caused by heat trapped in cities. I know a lot about climate change. The hole in the ozone layer causes climate change.	Van der Linden, 2015	3	$r = 0.51$	Continuous	8	Strongly agree-Strongly disagree; I don't know
Experience	Experience	Please check the environmental issues that you have personally experienced during your lifetime: Changes in precipitation Flooding Wildfires	Akerlof et al., 2013	-		Dichotomous	2	Yes/No
Socio-Cultural	Biospheric Values	For each value listed below, please rate the extent to which you consider it to be a guiding principle in your life: Preventing pollution Respecting the earth	Van der Linden, 2015	3	$\alpha = 0.85$	Continuous	9	Of extreme importance-Opposed to my values

Table 3 Continued. Instrument description including example questions for each construct, scale information, and Cronbach's alphas.

Socio-Cultural	Altruistic Values	For each value listed below, please rate the extent to which you consider it to be a guiding principle in your life: Promoting peace Having social justice	Van der Linden, 2015	3	α = 0.83	Continuous	9	Of extreme importance-Opposed to my values
Socio-Cultural	Egoistic Values	For each value listed below, please rate the extent to which you consider it to be a guiding principle in your life: Having authority Being influential	Van der Linden, 2015	3	α = 0.80	Continuous	9	Of extreme importance-Opposed to my values
Risk Perceptions	Risk	Please rate the following climate change factors based on your perception of this as a potential threat to coastal Maine. Extreme weather events Higher temperatures Increased rain	Van der Linden, 2015	7	α = 0.91	Continuous	4	High threat-Not a threat; Unsure

This table describes the variables used in our hierarchical regression analysis, including the number of questions (items) used to assess each sub-construct, their reliability for our sample, whether the variables were continuous or dichotomous, and the number of scale points, including whether or not there were scale options for "I don't know" and "Unsure," which were treated as missing data. For our risk construct, 9.1% indicated they were unsure. For all other constructs there was a less than 1% response rate for the "I don't know" option.

Table 4. Descriptive statistics for minimum, maximum, mean, standard deviation, and sample size for each sub-construct.

Sub-Construct	Scale Range	Mean	SD	Min	Max	N
Belief	1-6	4.32	0.71	2.20	5	424
Actual Knowledge	1-8	5.89	0.95	2.75	7	445
Perceived Knowledge	1-8	4.54	1.57	1	7	425
Experience	0-13	5.98	2.60	1	12	442
Biospheric Values	1-9	7.57	1.23	3.50	9	425
Altruistic Values	1-9	7.46	1.35	3.33	9	424
Egoistic Values	1-9	5.01	1.57	2	9	423
Risk	1-4	1.97	0.50	1	3	376

We present the range of the scales for each variable and descriptive statistics, including the mean, standard deviation, minimum and maximum values, and the N for each variable.

3.4 Results

3.4.1 Visitor Profile

We intercepted 1,317 visitor groups to ANP and 480 of those intercepted took the online follow-up survey, giving us a response rate of 36.45% (see Table 6 for participant demographics). Of those who participated in the follow-up survey, 84% were traveling as a family on vacation, with a mean size of 3.30. Top visitor activities included walking, sightseeing/driving for pleasure, hiking/backpacking, and eating lobster. Our sample was 59.44% women and our sample had a mean age of 51.98. Our sample was highly educated and identified as more politically liberal. When testing for response bias, there were no significant differences in cognitive, experiential, and socio-demographics between early and later respondents. While there was no significant difference between altruistic or egoistic values, the chi-square test revealed a difference in biospheric values orientation. Later respondents had higher biospheric values compared to earlier respondents.

Table 5. Intercorrelations between variables.

		Health message	Weather message	Gender	Political affiliation	Age	Belief	Actual knowledge	Perceived knowledge	Experience	Biospheric values	Altruistic values	Egoistic values
1	Health message												
2	Weather message	-0.52**											
3	Gender	0.06	-0.02										
4	Political affiliation	0.03	-0.01	0.07									
5	Age	0.03	0.02	-0.03	-0.10*								
6	Belief	0.09	-0.04	0.03	0.56**	-0.03							
7	Actual knowledge	0.03	-0.03	0.09	0.58**	-0.17**	0.74**						
8	Perceived knowledge	0.12	0.06	-0.13**	-0.38**	0.15**	-0.46**	-0.44**					
9	Experience	0.08	-0.12*	-0.02	0.31	-0.02	0.38**	0.35**	-0.11*				
10	Biospheric values	0.10*	-0.12*	0.10*	0.34*	0.10*	0.45**	0.46**	-0.15**	0.37**			
11	Altruistic values	0.12*	-0.10*	0.15**	0.41	0.04	0.44**	0.46**	-0.22**	0.32**	0.73**		
12	Egoistic values	0.04	-0.06	0.03	0.20	-0.03	0.22**	0.24**	-0.02	0.18**	0.38**	0.44**	
13	Risk	0.11*	-0.03	0.22**	0.40	-0.03	0.51**	0.48**	-0.31**	0.36**	0.46**	0.50**	0.30**

Note: *p<0.05, **p<0.01

3.4.2 Regression Results

The hierarchical regression analysis resulted in five models that included the messaging experiment, socio-demographics, cognition, experience, and socio-cultural factors. Model five explained the most variance (adjusted R^2=0.455) in visitor climate change risk perceptions (see Table 7 for regression results). Model 1 controlled for an experiment that is not included as part of this dissertation. Model 2 established a baseline with socio-demographic variables. Gender ($_\beta$=0.179, p<0.01) and political affiliation ($_\beta$=0.186, p<0.01) were significant predictors of risk perceptions. Identifying as female and having a liberal political affiliation significantly increased visitor climate change risk perceptions. Age was not a significant predictor ($_\beta$<0.01, p=0.773). Model 2 explained 21.9% of the variance in visitor climate change risk perceptions (F(5,292)=17.625, adjusted R^2=0.219, Δ adjusted R^2=0.214, p<0.01).

Model 3 incorporated three cognitive predictors, belief in climate change, actual knowledge, and perceived knowledge, to determine if additional variance in risk perceptions could be explained. Gender ($_\beta$=0.174, p<0.01) remained a significant predictor. Belief in climate change ($_\beta$=0.269, p<0.01) was the only significant cognitive predictor, meaning that participants with higher belief in climate change perceived their risk from climate change as higher. Actual knowledge ($_\beta$=0.060, p=0.120) and perceived knowledge ($_\beta$=-0.012, p=0.645) were not significant predictors of visitor climate change risk perceptions. Model 3 significantly explained more variance in climate change risk perceptions than model 2 (F(8,289)=22.567, adjusted R^2=0.367, Δ adjusted R^2=0.148, p<0.01).

Table 6. Visitor profile for participants who took the online follow-up survey.

Visitor Profile	Respondent Composition (%)
Gender	59
Female	40
Male	1
Prefer not to answer	
Age range	
18-30	10.5
31-50	34.1
51-70	49.4
71-over	6
Education	
High school or less	3.8
Some college	9.6
College degree	35.9
Graduate degree	50.7
Political affiliation	
Conservative	24.6
Neutral	23.6
Liberal	51.8
Main purpose of visit	
Business	0.4
Passing through	1.7
Vacation	89.6
Visiting family/friends	2.6
I live here, seasonal residence	3.4
Other	2.3
Travel group	
Self	4.4
Co-workers	0.8
Family	84
Friends	10.6
Other	2.7
First time visit to ANP	
Yes	61.2
No	38.8
Primary leisure activity	
Nature-based tourism	91.2
Cultural tourism	2.5
Shopping	0.4
Other	5.8

Table 7. Hierarchical regression results for all five climate change risk perception models.

Independent variables	Messaging	Socio-demographics	Cognition	Experience	Socio-cultural
	Model 1 (β)	Model 2 (β)	Model 3 (β)	Model 4 (β)	Model 5 (β)
Weather message	0.119	0.088	0.091	0.078	0.090
Health message	0.040	0.042	0.043	0.063	0.090
Gender	-	0.179**	0.174**	0.195**	0.172**
Political affiliation	-	0.186**	0.059*	0.047	0.027
Age	-	0.001	0.001	0.001	0.000
Belief	-	-	0.269**	0.229**	0.210**
Actual knowledge	-	-	0.060	0.040	-0.001
Perceived knowledge	-	-	-0.012	-0.016	-0.021
Experience	-	-	-	0.044**	0.038**
Biospheric values	-	-	-	-	0.023
Altruistic values	-	-	-	-	0.066**
Egoistic values	-	-	-	-	0.027
adjusted R^2	0.005	0.219	0.367	0.409	0.455
Δ adjusted R^2		0.214	0.148	0.042	0.046

*p<0.05, ** p<0.01. Entries are standardized beta coefficients. Model 1 controlled for a messaging experiment (not part of this paper), Model 2 added socio-demographic variables, Model 3 incorporated cognitive variables, Model 4 added experience, and Model 5 incorporated values orientations.

Model 4 added experience as a predictor of climate change risk perceptions. Gender (β=0.195, p<0.01) and belief in climate change (β=0.229, p<0.01) remained significant predictors. Experience was also a significant predictor of visitor risk perceptions (β=0.044, p<0.01). This means that as a visitor's level of experience with climate change impacts increased, their climate change risk perceptions also increased. As in the previous models, identifying as female and having higher belief in climate change increased visitor risk perceptions. This model explained

significantly more variance in visitor climate change risk perceptions than the previous model ($F(9,288) = 23.803$, adjusted $R^2=0.409$, Δ adjusted $R^2=0.042$, $p<0.01$).

Model 5 incorporated value orientations (biospheric, altruistic, and egoistic). Gender ($\beta=0.172$, $p<0.01$), belief in climate change ($\beta=0.210$, $p<0.01$), and experience ($\beta=0.038$, $p<0.01$) remained significant predictors. Altruistic value orientation was a significant predictor in model 5 ($\beta=0.066$, $p=0.007$). Visitors with higher altruistic values had higher risk perceptions. Model 5 significantly explained more variance in visitor risk perceptions ($F(12,285)=21.633$, adjusted $R^2=0.455$, Δ adjusted $R^2=0.046$, $p<0.01$). Our fifth model explained the most variance in visitor climate change risk perceptions.

Based on the results of these analyses, we found partial support for Hypothesis 1 as identifying as female was associated with increased risk perceptions; however, political affiliation was not significant in later models. We partially accept our second hypothesis as higher belief in climate change was significantly associated with increased risk perceptions, but actual knowledge and perceived knowledge were not significant predictors. We accept Hypothesis 3 as more experience with climate change impacts was associated with higher risk perceptions. We partially accept our fourth hypothesis as a higher altruistic values orientation was a significant predictor of risk perceptions; however, having a higher biospheric values orientation did not significantly increase visitor climate change risk perception.

3.5 Discussion

The goal of this study was to understand the role that socio-demographic, cognitive, experiential, and socio-cultural factors have in determining climate change risk perceptions in visitors to ANP. Our results indicate that gender, belief in climate change, experience, and altruistic values are all significant predictors of climate change risk perceptions (Model 5) and

accounted for 45.5% of variance in visitor climate change risk perceptions. Consistent with prior studies, female participants had higher climate change risk perceptions than male participants (De Urioste-Stone et al., 2015; Scannell & Gifford, 2011; van der Linden, 2015). Surprisingly, political affiliation was not a significant predictor in the final model. This could be related to participants weakly identifying with a political affiliation, thereby reducing the importance of political orientation on climate change perceptions. Previous studies have found that a liberal political affiliation increases climate change risk perceptions (Lee, Markowitz, Howe, Ko, & Leiserowitz, 2015; Safi et al., 2012), though not always (Kellstedt et al., 2008).

3.5.1 Higher Climate Change Belief Increases Risk Perceptions

Unsurprisingly, higher levels of anthropogenic climate change belief resulted in higher risk perceptions (Lee et al., 2015). Knowledge of climate change and perceived knowledge were non-significant predictors. Previous work by van der Linden (2015) delineated between cause, impact, and response knowledge, all of which significantly predicted climate change risk perceptions in his sample of UK residents. Informing the public about the consequences of climate change (impact knowledge) was more effective in promoting mitigation behaviors among an environmentally active sample than communicating cause knowledge or response knowledge (Ortega-Egea, García-de-Frutos, & Antolín-López, 2014). Conversely, knowledge of climate change has resulted in lower concern for its effects and lower feelings of responsibility in taking climate action (Kellstedt et al., 2008). Though not within the context of climate change, Masuda and Garvin (2006) also noted the relationship between cultural world views, norms, and participants' risk perceptions. Their findings indicate that individual place-based experiences and cultural worldviews impacted risk perceptions (Masuda & Garvin, 2006). While norms related to climate change behavior (i.e., adaptation and mitigation) were not included in our survey, these

studies suggest a potentially complex connection between knowledge, norms, culture, and risk perceptions that merits further study.

3.5.2 Experience with Climate Change Impacts Increases Risk Perceptions

While climate change cannot be directly experienced, climate change impacts offer an indirect way to experience this large-scale, global phenomenon. Consistent with previous work, experience with climate change impacts was a significant predictor of climate change risk perceptions (Demski et al., 2017; Spence, Poortinga, Butler, & Pidgeon, 2011; van der Linden, 2015). The role of experience with climate change impacts is reliant on participants being able to connect events with climate change as a cause (Brügger, Dessai, Devine-Wright, Morton, & Pidgeon, 2015; Safi et al., 2012). Experience with climate impacts can increase the saliency of climate change for individuals, and perceived issue saliency can be important in predicting climate change risk perceptions (Yang et al., 2014).

3.5.3 Visitors with Altruistic Values Orientation have Higher Risk Perceptions

Previous studies found that participants with high biospheric values tend to have higher climate change risk perceptions (Gifford & Nilsson, 2014; van der Linden, 2015; Yang et al., 2014). In our study, a high biospheric value orientation was not a significant predictor of climate change risk perceptions. This is perhaps because biospheric values were very high among all participants, as you might expect of visitors to a national park. We did find that having a more altruistic values orientation increased climate change risk perceptions. This could perhaps be explained by recent studies unpacking psychological distance. The concept of psychological distance from construal level theory has been applied to suggest that making a hazard more salient or psychologically closer to an audience (e.g., geographically local, personally impacted, more immediate time scale, and high likelihood of occurring) would increase the perception of

risk associated with it (Zwickle & Wilson, 2014). More recent studies have highlighted that psychologically close threats do not necessarily translate into high perceived risk (Brügger et al., 2015; Schuldt, Rickard, & Yang, 2018; Spence, Poortinga, & Pidgeon, 2012). In relation to altruistic values orientation, some studies suggest that highlighting the risks to other people (more psychologically distant) increases risk perceptions and willingness to act (Spence et al., 2012), though not all studies agree (Schuldt et al., 2018). Based on our results, it may be that altruistic emotions related to ANP caused visitors to care about the area.

3.5.4 Limitations and Future Research

Future research could examine the influence of affective response or social norms on visitor climate change risk perceptions. Affect has been an important predictor of climate change risk perceptions in previous studies (Poortinga, Spence, Whitmarsh, Capstick, & Pidgeon, 2011; Shakeela & Becken, 2015) and would likely increase the predictive power of our model. People typically feel obligated to act in accordance with their values, and thus normative behaviors arise from values if norms are activated (DeGroot & Steg, 2007; Stern, 2018).

Visitation has been increasing to ANP in the fall season, and we believe that visitor demographics for fall visitors are different from summer visitors (i.e., older, fewer families, more Maine residents, etc.), which could result in differences in visitor risk perception (especially if comparing residents to non-residents). Our sample includes primarily summer visitors; future research could concentrate on increasing the sample of fall visitors, especially to explore if differences between residents and non-residents visiting ANP exist. Additionally, we had a response bias in our biospheric values construct where later respondents had higher biospheric values than earlier respondents, indicating that our study was not comprehensively generalizable

to all ANP visitors. Given that no other constructs had a response bias, the significant predictors of climate change risk perceptions in our model are likely representative of visitors to ANP.

3.5.5 Management Implications

We applied theories from risk studies and social psychology to add to the body of outdoor recreation and tourism literature on climate change risk perceptions. Consistent with other studies in different contexts, our findings indicate that gender, belief in climate change, experience with climate impacts, and altruistic values increase visitor risk perceptions. Tourism is expected to continue to increase in the coming decades (UNWTO, 2020) and visitation to ANP is also predicted to increase (Fisichelli et al., 2015). It is important to understand visitor climate change risk perceptions to manage visitor use and provide a satisfactory tourism experience. It seems unlikely that visitation will decrease to protected areas in the short-term regardless of visitor climate change risk perceptions (Coombes, Jones, & Sutherland, 2009; Dillimono & Dickinson, 2015; Fisichelli et al., 2015; Hestetune et al., 2018; Seekamp et al., 2019). Visitor management is therefore key as protected areas experience climate impacts (e.g., extreme weather events, increased presence of ticks, and disease outbreaks) that are likely to impact visitor experiences and resource management.

Implications of our study suggest that if park managers and other tourism stakeholders want to convey information about climate change with the goal of influencing perceptions and behaviors, we suggest that they focus on visitor experiences with climate change impacts and appeals to altruistic values. For example, managers could draw attention to changes being observed, such as warmer fall seasons and increased extreme weather events, to illustrate ideas about changing climate in their educational outreach campaigns. Communication appealing to visitors' sense of altruism, such as emphasizing collective action messages, might be effective in

increasing climate change risk perceptions and possibly encouraging climate friendly behavior, such as riding the bus instead of driving in the park (Hathaway, 2019).

Understanding how visitors process climate change risks will help protected area managers understand how to effectively communicate changes affecting the park that might also impact visitor experiences (e.g., safety, access, etc.) (Wang & Pfister, 2008) and resource management. For example, a recent study found that communicating increased hazard levels from extreme weather events did little to discourage outdoor recreation among visitors to Minnesota's north shore (Kanazawa et al., 2018). This suggests that managers need to find different ways to appeal to visitor risk perceptions other than providing official warnings and that risk perceptions do not necessarily translate into behavioral outcomes (Kanazawa et al., 2018). Protected area managers will have to increasingly communicate climate change risks to visitors at different stages of their trip (Jonas & Mansfeld, 2017), and understanding how to motivate compliance with park policies will be critical in maintaining positive visitor experience. Visitors understanding their role in contributing to climate change could be important for encouraging mitigation and adaptation behaviors (Bateman & O'Connor, 2016).

Additionally, adaptation initiatives within ANP could alleviate any negative shifts in visitor perceptions and behaviors, such as perceived loss of scenery, unappealing climatic image, or belief that the destination is no longer safe (Atzori et al., 2018; Bujosa, Torres, & Riera, 2018; McCreary et al., 2018). In a recent study at Acadia National Park, visitors who engaged in a greater number of nature-based tourism activities (nature-based tourism generalists) were more willing to engage with climate change mitigation behaviors (Wilkins et al., 2018b). Visitors aware of climate change are likely to demand more infrastructure and climate adaptation policies and might be more willing to pay for those initiatives (McCreary et al., 2018). Understanding

visitor risk perceptions and expectations could help tourism stakeholders in coastal destinations and national parks adapt to continue to meet visitor expectations, ultimately maintaining the long-term competitiveness of the tourism industry and maintain the integrity of the natural and cultural resources even as climate conditions continue to change.

3.5.6 Conclusions

Climate change risk perceptions can predict shifts in visitation, including spatial and temporal patterns to tourism destinations. In this study, we assessed the underlying psychological and social factors that explain climate change risk perceptions of visitors to a protected area destination, Acadia National Park. Using a hierarchical regression analysis, we explained 45.5% of the variance in visitor climate change risk perceptions. Identifying as female, belief in climate change, experience with climate change impacts, and a high altruistic values orientation significantly predicted climate change risk perceptions. This study contributes to the growing body of literature on visitor risk perceptions by applying theories from risk studies and social psychology. Our findings may help inform visitor management by suggesting ways to communicate with visitors to alleviate negative perceptions associated with climate change impacts within national parks and protected areas while also motivating compliance with natural and cultural resource management regulations.

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CHAPTER 4: CLIMATE CHANGE RISK PERCEPTIONS AND BEHAVIORAL ADAPTATION OF TOURISM STAKEHOLDERS, A CASE STUDY OF DESTINATION RESILIENCE

4.1 Chapter Summary

Climate and weather are important factors influencing the global tourism economy. Climate change will create challenges and opportunities for nature-based tourism destinations with shifts in visitation, how tourism products are developed and advertised, and how natural and cultural resources are managed. Risk perceptions can be an important predictor of behaviors that influence destination resilience, including changes in visitation patterns and the adoption of adaptation and mitigation initiatives by tourism suppliers. In this study we use a case study methodology to understand the resilience of a coastal nature-based tourism destination by capturing stakeholders' (i.e., businesses, managers/planners, and visitors) risk perceptions and resulting behavioral responses to climate change on Mount Desert Island, Maine, U.S.A. During the summer of 2018, we conducted an intercept survey to sample visitors to Acadia National Park to measure climate change risk perceptions and intended behavioral adaptations. We used semi-structured interviews to understand tourism suppliers' perceptions of climate change and adaptation and mitigation responses. Archival evidence analysis helped us gain a deeper understanding of the case context and to provide further evidence to support conclusions. Findings suggest that there are multiple intersections in tourism suppliers' and consumers' perceptions of threats to tourism on Mount Desert Island, including increased ticks and extreme weather events. A notable area of divergence is tourism suppliers' concern for overcrowding within Acadia National Park as visitation continues to increase as temperatures warm. Both tourism suppliers and visitors are adapting or intend to adapt to climate change impacts that

affect nature-based tourism. Visitors are likely to engage in substitution behaviors, including visiting other destinations in the U.S.A., visiting Mount Desert Island at another time of year, and changing the activities in which they participate. Tourism suppliers are making infrastructure improvements, changing the timing of business models, and investing in solar energy projects as adaptation and mitigation strategies. By studying both supplier and visitor risk perceptions, we gain a better understanding of how supply and demand interact as a result of climate change. The dynamic nature of this relationship and the ability of suppliers to anticipate and meet visitor demand under future climate change scenarios influences destination resilience.

4.2 Introduction

Tourism is an important and growing global economic industry (UNWTO, 2020), which has been described as a climate-sensitive economic sector because of its reliance on environmental and climatic conditions (UNEP, 2008). Within destinations, climate defines the timing, length, and quality of tourism seasons, influencing visitor destination selection and spending (UNEP, 2008; Wilkins, De Urioste-Stone, Weiskittel, & Gabe, 2018). Climate change will therefore continue to pose challenges and opportunities for destinations. Coastal tourism destinations are especially at risk to climate change because of impacts like sea level rise, saltwater intrusion, flooding, erosion, and extreme weather events (UNWTO, 2016). How tourism stakeholders, suppliers and consumers, perceive their risk to these coastal climate impacts will likely influence behavioral responses, such as adaptations, and long-term destination resilience. Adaptation in human systems refers to adjustments to actual or perceived climate change effects to alleviate harm or take advantage of opportunities (Oppenheimer et al., 2014).

4.2.1 Destination Resilience and the Tourism Area Life Cycle Model

Gunn and Var (2002) conceptualize tourism destinations as a community or group of communities that provides access points, gateways, and connections to attractions. With this conceptualization in mind, we can apply the concept of community resilience to understand how tourism destinations maintain, renew, or reorganize their functions while coping with climate change and its uncertain impacts (Magis, 2010). A key concept in resilience thinking is that of the adaptive cycle, which involves disturbance, reorganization, and renewal (Chapin et al., 2009). Specifically, the adaptive cycle consists of four functional phases that characterize the evolutionary trajectory of a system: exploitation (r), conservation (K), release (Ω), and reorganization (α) (Figure 6).

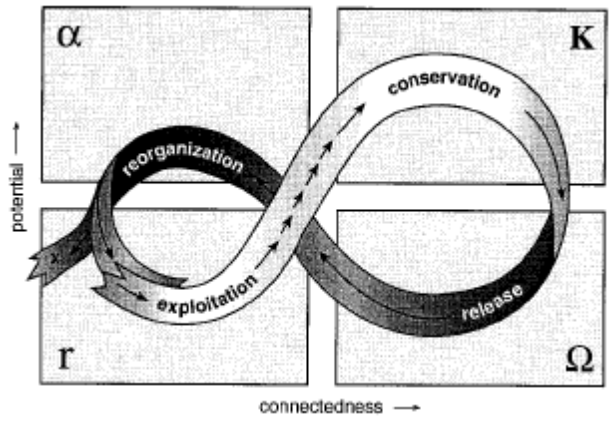

Figure 6. The adaptive cycle (Holling, 2001)

Resilience starts to develop during the initial r phase, increases rapidly during the K phase, peaks and then collapses during the Ω phase, and remains low during a regime collapse (Davidson, 2010). The concept of the adaptive cycle and Butler's Tourism Area Life Cycle (TALC) model are complementary as destinations adapt and evolve in response to changing market conditions (Pearce, 2014). According to the TALC (Figure 7), a destination begins in the

early stages of development (exploratory, involvement) and eventually grows to later developmental stages (development, consolidation) through product development, advertising, and increased visitation (Bojanic, 2003). Eventually a destination reaches maximum capacity where tourism has saturated the market and negative impacts are perceived by consumers, suppliers, and residents (Bojanic, 2003). Tourism destinations are then faced with the choice to either stabilize (akin to maintaining their functions), rejuvenate the destination (akin to renewing or reorganizing their function), or decline (akin to collapse) (Lew & Cheer, 2018). The ability of destinations to match their products with tourism demand is essential in maintaining the long-term attractiveness of the destination as it moves through these development phases (Formica & Uysal, 2006). By incorporating resilience thinking into the TALC, we can acknowledge the linkages between tourism, the adaptive cycle, and resilience theory (Duke et al., 2018).

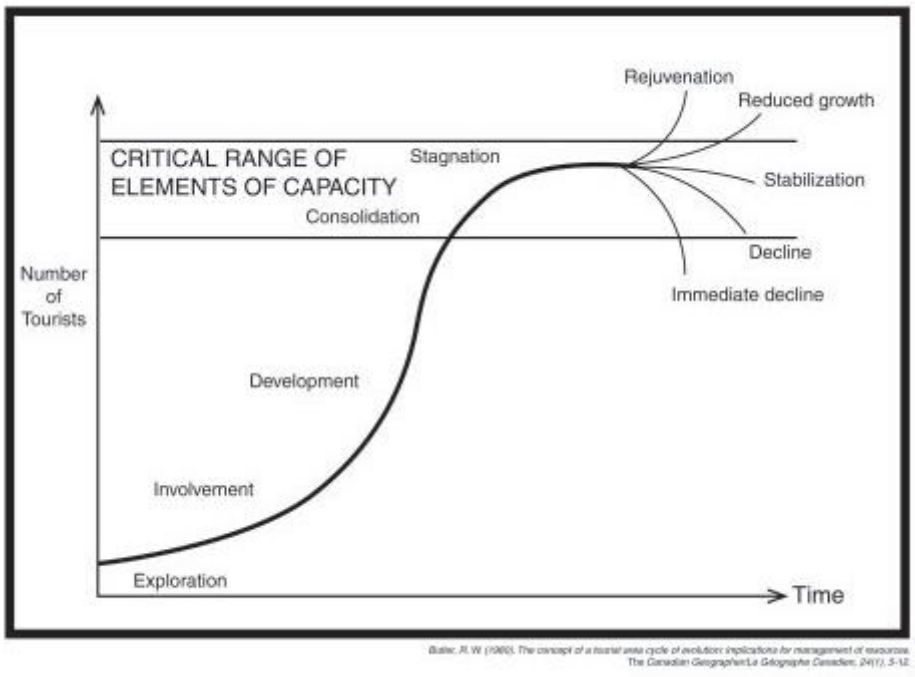

Figure 7. Butler's Tourism Area Life Cycle (TALC) model (Lew & Cheer, 2018).

4.2.2 Climate Change Risk Perceptions

Risk perceptions are subjective assessments of the probability of a risk event happening and how concerned we are with the consequences (Bodemer & Gaissmaier, 2015). Climate change risk perceptions are specifically directed to information processing and sensemaking related to climate change as an external threat, phenomenon, or situation (Shakeela & Becken, 2015). Risk perceptions are complex and multifaceted, often shaped by socio-demographic factors, cognitive factors, experiential processing, and social structures (De Urioste-Stone et al., 2015; Horne, De Urioste-Stone, Daigle, & Noblet, 2018; van der Linden, 2015). Risk perceptions can influence behavioral responses, such as tourism supplier decisions to adapt or mitigate and visitor behaviors related to destination selection, activity participation, and seasonal visitation patterns (Haegeli & Pröbstl-Haider, 2016; Huebner, 2012; Karl, 2018; Perry et al., 2018). These behaviors have long-term implications for the resilience of a tourism destination as they have the potential to disrupt supply and demand (Amelung & Moreno, 2012), which must be continuously aligned to provide satisfactory tourism products while also contributing to the destination's economy (Gunn & Var, 2002). It is therefore important to understand how tourism suppliers and consumers perceive their risk from hazards, in this case climate change, and how those perceptions shape their resulting behavioral responses, if at all.

4.2.2 Visitor Risk Perceptions and Behavioral Responses

Tourism is an important part of many economies and shifts in visitation due to climate change could potentially have large economic impacts. Understanding visitor responses to climate change are therefore important in predicting potential economic changes, as well as helping tourism suppliers anticipate and effectively respond to these shifts. Weather patterns and climate conditions are typically important considerations for travelers (Coombes et al., 2009;

Hendrik & Jeuring, 2017; Lise & Tol, 2002; Perry et al., 2018), though not always (Gössling & Hall, 2006). Climate change impacts can alter the desirability of and access to destinations, influencing visitor flows (Bicknell & McManus, 2006; Bigano, Bosello, Roson, & Tol, 2008; Dillimono & Dickinson, 2015; Moore, 2010). Climate change risk perceptions can predict shifts in visitor behaviors (e.g., destination selections, shifts in seasonal visitation, and activity participation) (De Urioste-Stone, Scaccia, & Howe-Poteet, 2015; Kanazawa, Wilson, & Holmberg, 2018; Karl, 2018; Perry et al., 2018); however, studies have also found that climate change risk perceptions will likely have a limited effect on travel decisions (Hestetune et al., 2018; Lise & Tol, 2002; Seekamp et al., 2019).

Visitors have the greatest ability to adapt to climate change impacts, as they can shift behaviors by engaging in substitutions (Dawson et al., 2013). For example, visitors can engage in a variety of coping behaviors, including temporal, spatial, activity, and strategic substitutions (Dawson et al., 2011; McCreary et al., 2019). These substitutions are often determined by visitor characteristics and perceptions, such as gender, age, climate change belief, risk perceptions, and outdoor recreation experience levels (De Urioste-Stone et al., 2015; Rutty et al., 2015; Welling, Þorvarður, & Rannveig, 2020; Wilkins et al., 2018). As climate conditions change along the coast of Maine, understanding visitor risk perceptions could help tourism stakeholders in coastal Maine destinations adapt their products and services to continue to meet current visitor expectations and potentially identify and target emerging tourism markets.

4.2.3 Tourism Supplier Risk Perceptions and Responses

There is growing recognition of the need to adapt to climate change and adopt mitigation strategies that reduce the carbon footprint of the industry, while also supporting economic development (UNWTO, 2016). Tourism suppliers' climate change risk perceptions might impact

whether or not mitigation and/or adaptation strategies are employed or supported (Kettle & Dow, 2016; Oppenheimer et al., 2014; Shakeela & Becken, 2015); however, some studies have found that stakeholders believe adaptation is the responsibility of the government or other organizations rather than tourism suppliers (Buys, Miller, & Megen, 2012; Fitchett, Grant, & Hoogendoorn, 2016; Mushawemhuka, Rogerson, & Saarinen, 2018). In other cases, suppliers recognize their risk from climate change and are able to adapt as individuals, such as a business owner creating programming/products for poor weather days to appeal to visitor demand (Csete and Szécsi, 2015). Previous studies have found that knowledge of climate change and its impacts is relatively high in the tourism industry but does not necessarily translate into adaptation behaviors (Saarinen et al., 2012). While many tourism suppliers recognize their risk from climate change on some level, inaction is common due to a variety of reasons, such as not perceiving immediate action as necessary, not knowing how best to address climate change, or not having the resources to adapt to such a long-term, psychologically distant phenomenon (Gifford, 2011; Horne, De Urioste-Stone, & Daigle, *in prep*; Mushawemhuka et al., 2018; Saarinen et al., 2012; Tervo-Kankare, 2018; Trawöger, 2014).

Understanding tourism suppliers' risk perceptions of climate change in coastal Maine and behavioral responses (in place or intended) will help identify how providers can cope with negative climate change impacts and take advantage of potential opportunities. These adaptation actions should be informed by an understanding of visitor risk perceptions and potential shifts in travel behaviors. Assessing visitors' perceptions of risk will help stakeholders understand how travel behavior may be influenced by changes in climate to ensure a match between supply and demand, ensuring destination resilience. Aligning supply and demand is a dynamic process and is fundamental for maintaining the long-term sustainability and competitiveness of a tourism

destination (Formica & Uysal, 2006; Gunn & Var, 2002). Destination adaptations also have the ability to counter visitor climate change risk perceptions and avoid undesirable shifts in visitation. For example, visitors to coastal destinations in Florida indicated high intention to visit different destinations should climate change conditions worsen but were willing to continue visiting Florida should adaptation measures, such as beach restoration and flood mitigation, be adopted (Atzori et al., 2018). It is helpful to understand risk perceptions of tourism suppliers and visitors within a destination to gain a more holistic understanding of how these views interact to influence destination resilience to climate change.

The goal of this study was to understand climate change coastal destination resilience by studying tourism suppliers' and consumers' risk perceptions, behavioral responses, and the contextual factors that frame this phenomenon. By studying both supply and demand perspectives, we gain a better sense of destination resilience to future shocks and stressors. To address this goal, our study was guided by three research sub-questions:

1. What are the various climate change risk perceptions of visitors and tourism suppliers on Mount Desert Island, Maine, U.S.A.?

2. How, if at all, are visitors and tourism suppliers responding or intending to respond to perceived threats and/or opportunities resulting from climate change?

3. Do inconsistencies exist in demand and supply climate change risk perceptions and behavioral responses?

4.3 Methods

4.3.1 Study Site

Mount Desert Island (MDI) is one of the most highly visited destinations in the state due to the presence of Acadia National Park (ANP). The island includes the towns of Mount Desert, Bar Harbor, Southwest Harbor, and Tremont (Figure 5) and has a year-round population of

approximately 10,000 residents (United States Census Bureau, 2010). Bar Harbor serves as an important gateway community as the majority of hotel, restaurant, and shopping services are concentrated here, as well as many tourism businesses. ANP attracts around 3.4 million visitors annually (NPS, 2020b). Peak visitation occurs during summer with July and August receiving the most visitors (Carrillo & De Urioste-Stone, 2017). In 2017, visitors to ANP generated $578 million with an estimated economic impact to Hancock County of $665 million via job creation, taxes paid, and tourism money spent in other industries (Carrillo & De Urioste-Stone, 2017; Cullinane, Koontz, & Cornachione, 2018). The majority of visitors to MDI are not local residents and primarily visit for vacation (87%) — this group accounted for 89% of visitation in a 2015 study and the majority of tourism expenditures (89%, $515 million) (Carrillo & De Urioste-Stone, 2017; Cullinane et al., 2018).

ANP's key features include many nature-based attractions, including scenic views, coastal drives, and nature-based recreational activities like hiking, boating, and camping. The park also features cultural attractions, including the carriage roads, the Park Loop Road, and Jordan Pond House. Because many of the attractions in ANP are reliant on natural features, they are likely to change under climate conditions. Some of the climate change impacts affecting coastal Maine, including our study area, include increases in average annual temperatures, increases in annual precipitation, changes in seasons (e.g., longer summers, shorter winters, and extended shoulder seasons), rising sea levels, more frequent extreme weather events, and shifts in species (Fernandez et al., 2020; Horton et al., 2014). Visitor numbers are also expected to increase under climate change (Fisichelli et al., 2015), along with visitor spending as a result of the longer summer season (Wilkins et al., 2018). To maintain tourism destination resilience, suppliers must consider how climate change can result in the loss of attractions, seasonal

inaccessibility, and changing visitor markets (Lew & Cheer, 2018). A resilient tourism destination relies on the alignment of supply and demand and the ability of the destination to offer a desirable consumer product, a relationship that is constantly being assessed (Gunn & Var, 2002). If visitor demand and tourism suppliers' product offerings do not match, there can be a decline in visitor satisfaction, decreased visitation, and a loss of livelihood strategies in the host communities. Tourism suppliers must therefore anticipate climate change impacts and future shifts in visitation to guarantee their product offerings match visitor demand to ensure long-term destination resilience. The economic importance of the MDI area and ANP to Maine's tourism economy and the range of expected climate impacts make it an illustrative case to understand the importance of climate change risk perceptions and potential behavioral responses.

4.3.2 Methodology

We adopted a single, instrumental case study methodology to better understand how stakeholders' risk perceptions and behavioral responses relate to climate change destination resilience (De Urioste-Stone, McLaughlin, Daigle, & Fefer, 2018; Stake, 2006). Suppliers' understanding of climate change impacts and their ability to anticipate shifts in visitor demand will determine alignment between supply and demand, which has implications for long-term destination resilience. We chose a case study methodology because it allowed us to focus on the how and why of the phenomenon and to take contextual conditions into account while adding to our comprehensive understanding of our study phenomenon (Baxter & Jack, 2008; Yin, 2014). Our participants' realities and behaviors are inextricably linked to the conceptual, temporal, physical, and social context within which they live and work, and a case study allows us to study context, perceptions, and behaviors as we interpret the multiple facets of our participants' lives

within this tourism destination (Stake, 2006). A case study methodology is appropriate when the context is both critical to and cannot be removed from the phenomenon under study (Yin, 2014). For our study, the interconnection between rural communities, visitors, and the natural resource base upon which they depend makes context important when considering these stakeholder realities. A case study allows for multiple aspects of a problem to be studied simultaneously to yield a thicker description of the phenomenon being examined within a local situation (Stake, 2006). The case study design allowed us to collect data from multiple sources (i.e., business providers, managers/planners, and visitors) and data collection methods that contributed to our knowledge of the phenomenon, and when "braided together" helped create a deeper understanding of the case (Baxter & Jack, 2008; Yin, 2014). Using a case study methodology also allows for prolonged engagement with the case, while triangulating across multiple methods (i.e., interviews, archival evidence, and a visitor survey) to achieve a greater and deeper understanding of the case phenomenon and context (De Urioste-Stone et al., 2018).

4.3.4 Methods

4.3.4.1 Semi-Structured Interviews

We conducted 24 semi-structured interviews with follow-up probes to understand and describe the lived experiences of participants and how they experience climate change (Flick, 1998; Moustakas, 1994). Using destination promotional materials (e.g., Chamber of Commerce websites, Tripadvisor, and business web pages), we created an initial list of potential interviewees who could represent voices from different types of stakeholders (e.g., tourism business owners, National Park Service employees, municipal officials, etc.). We used snowball sampling whereby participants recommended potential contacts (Patton, 2015) to identify additional participants whose voices were important to incorporate. We interviewed a variety of

nature-based tourism stakeholders important in tourism planning and development in the region, including business owners (7), staff from non-profits whose mission/work includes tourism (8), local municipal workers (4), and National Park Service employees (5) (see Table 8 for more participant details).

Table 8. Participant details, pseudonyms, and data generated.

Participant pseudonym	Role	Data generated	Type of interview
Marcus	NPS	Interview, pile sort	In-person
Elizabeth	Conservation non-profit	Interview, pile sort	In-person
Tyler	Conservation non-profit	Interview, pile sort	In-person
Jessica	Conservation non-profit	Interview, pile sort	In-person
Ryan	Business owner	Interview, pile sort	In-person
Dianne	Municipal leader	Interview, pile sort	In-person
Lucas	Municipal leader	Interview, pile sort	In-person
Heather	Tourism non-profit	Interview, pile sort	In-person
William	NPS	Interview, pile sort	In-person
Bob	Business owner	Interview, pile sort	In-person
Amanda	Wildlife non-profit	Interview, pile sort	In-person
Henry	Municipal leader	Interview, pile sort	In-person
Alyssa	NPS	Interview, pile sort	In-person
Ben	Conservation non-profit	Interview, pile sort	In-person
George	NPS	Interview, pile sort	In-person
Jake	Conservation non-profit	Interview, pile sort	In-person
Albert	Municipal leader	Interview, pile sort	In-person
Emily	Business owner	Interview, pile sort	In-person
Daniel	NPS	Interview	Phone
Korey	Business owner	Interview	Phone
Michelle	Youth non-profit	Interview	Phone
Jake	Business owner	Interview	Phone
Ingrid	Business owner	Interview	Phone
Adele	Business employee	Interview	Phone

Face-to-face interviews included a pile sort activity where participants were given 46 cards each containing an environmental or social condition subject to variability as a result of climate change (see Appendix B for pile sort terms). While the pile sort analysis is not included in this chapter, the activity itself prompted deeper conversation about climate change impacts to the

area. Interviews were recorded and transcribed verbatim to be as close to participants' meanings as possible (Kowal & O'Connell, 2014). We interviewed participants from Fall 2017 to Spring 2020, both in-person and over the phone if face-to-face interviews were not possible. Interviews were typically 60-90 minutes in length. We recorded interviews with participant permission and jotted notes during the interview. Data were stored and analyzed in NVivo 11 Pro ©.

4.3.4.2 Archival Evidence and Documentary Information

Archival evidence and documentary information included newspaper articles from the past five years discussing climate change and tourism in the destination, government documents, research reports, non-profit publications such as newsletters, planning documents, past visitor surveys, and websites (Yin, 2014). A review of the archival evidence was used to triangulate across data sources, increasing the richness of the case and understanding of the context (Baxter & Jack, 2008). Evidence was downloaded and added to the NVivo database (De Urioste-Stone et al., 2018). Shorter documents were coded akin to interviews for key ideas; longer documents contained abstracts or executive summaries, which were coded for key ideas (De Urioste-Stone, 2003). While the archival evidence did not add any new ideas, these documents were compared with interview and survey findings as a means of triangulation and to enhance credibility (Kamrath, 2015).

4.3.4.3 Visitor Survey

During Summer 2018, we surveyed visitors to ANP to measure the effect of social-psychological factors in determining tourist climate change risk perceptions and travel behavior. From May to September 2018, our team of researchers approached tourists at visitor centers, trail heads, and key outdoor recreation attractions at ANP to ask them to take a short face-to-face

front-end survey, followed by a longer online survey after they completed their visit (Dillman et al., 2014). The front-end survey asked about visitor travel behavior and group characteristics. Upon completion of the front-end survey, we gave visitors a postcard with a link to the online follow-up survey and asked for their contact information so that we could send up to two follow-up postcards or e-mails to increase our response rate (Dillman et al., 2014). The online follow-up survey included close-ended questions with previously tested scales that measured socio-demographics, cognitive factors, experiential processes, and socio-cultural factors to assess risk perceptions among tourists and behavioral intention to substitute (van der Linden, 2015). Data collection, analysis, and results are reported in more depth in chapter three.

4.3.5 Analysis

4.3.5.1 Qualitative Data Analysis

I used NVivo 11 Pro© to analyze interview data and archival evidence using an iterative process to (1) summarize data through open coding, (2) display coding categories through matrices, concept maps, and quotations, and (3) draw conclusions (De Urioste-Stone et al., 2018). These codes were later organized into pattern codes where ideas were connected into meaning units (Miles et al., 2020). Through an iterative coding approach, I used multiple rounds of coding, concept maps, matrices, and analytical and reflective memoing to draw conclusions (De Urioste-Stone et al., 2018). Archival evidence and documentary information were analyzed in NVivo 11 Pro alongside interview data to identify codes, patterns, and themes (Yin, 2014).

4.3.5.2 Quantitative Survey Analysis

We calculated descriptive statistics in IBM SPSS 24 for socio-demographics, cognition, experiential processing, socio-cultural factors, and risk variables. For all constructs, total scores

were calculated and data were winsorized using z-scores to account for univariate outliers (for descriptive statistics, see Tables 4 and 5) (Tabachnick & Fidell, 2013). In this chapter we focus on univariate descriptive frequencies from the visitor survey.

4.3.6 Quality Assurance

4.3.6.1 Qualitative

We took multiple steps to ensure trustworthiness by addressing credibility, dependability, confirmability, and transferability (see Table 9 for summary). To ensure credibility, we included open-ended interview questions, acknowledged the role of the researcher in shaping the interviews and research process, and triangulated across multiple sources of data (Patton, 2015). Triangulation is a process of repeated data gathering and critical review of data to lead to a comprehensive understanding of the case and to confirm our interpretation (Patton, 2015). Collecting multiple sources of data can be time consuming, but multiple sources of data are essential in ensuring trustworthy results. To further enhance credibility, the process of triangulation across multiple sources of data helped ensure that the case was studied from multiple perspectives (Baxter & Jack, 2008), and we used an audit trail that included reflective memos to acknowledge the impact the primary researcher had on the study and examine personal biases (Creswell, 2013). By reading through the interview transcripts multiple times and engaging in regular peer debriefing, we enhanced the credibility of our conclusions (Miles et al., 2020). In addition to reflective journals, using NVivo 11 Pro© to create a database enhanced the dependability and confirmability of our work, as did the use of consistent data generation protocols and an audit trail documenting steps in the research process (De Urioste-Stone et al., 2018). We address transferability concerns by using in-depth interviews with participants and

including a detailed descriptions of the methods, as well as relying on reflective journals (Miles et al., 2020).

Table 9. Steps taken to ensure trustworthiness of the research.

Trustworthiness Component	Researcher steps to ensure trustworthiness
Credibility: the fit between the views of participants and the interpretation of the researchers (De Urioste-Stone et al., 2018)	• Open-ended interview questions • Reflective journals and acknowledging the role of the researcher throughout process • Triangulation • Audit trail • Memoing • Peer debriefing • Multiple readings of transcripts • Triangulation
Dependability: documentation of research process (Yin, 2014)	• NVivo database • Reflective journal • Consistent use of protocols
Confirmability: reasonable freedom from researcher bias and explicitness where biases exist (Miles et al., 2020)	• NVivo database • Reflective journal • Audit trail • Peer debriefing
Transferability: demonstrate how study can be applied to and/or replicated in other contexts (Patton, 2015)	• In-depth interviews • Reflective journal • Detailed descriptions of methods

4.3.6.2 Quantitative

To seek generalizability of survey results, we randomly selected survey dates and locations within the park; once on site, visitor groups were chosen using an interval sampling strategy (interval range of 1-10 depending on visitor density) to reduce sampling bias (Scheaffer et al., 2012; Wilkins et al., 2018). Instrument items and scales were adapted from previously validated studies, and we used Cronbach's alpha to determine internal consistency (Black, 1999). Data were winsorized and univariate and multivariate outliers were dropped from analysis to limit the effects of extreme responses (Tabachnick & Fidell, 2013). We also tested for response

bias using Pearson's chi-square test to compare factors between earlier and later respondents from the online survey (De Urioste-Stone, Le, Scaccia, & Wilkins, 2016).

4.4 Results

This section begins by describing the climate change risk perceptions and challenges and opportunities to tourism stakeholders (i.e., suppliers and visitors) on MDI. Results describe perceptions that were found to be important for both groups. We will then describe behavioral responses to climate change in each group before illustrating similarities in perceptions and behaviors across groups with implications for destination resilience.

4.4.1 Tourism Suppliers' Experiences with Climate Change Impacts

4.4.1.1 Extreme Weather Events and Infrastructure

Experience with climate change impacts was an important factor in tourism suppliers' risk perceptions. Extreme weather events (e.g., intense precipitation events, storm surges), higher average temperatures, and changes in seasons (e.g., longer fall tourism season) were experienced by interviewees on MDI. These extreme events were connected to concerns about infrastructure, which was described as aged, in need of updating, and being vulnerable due to its location close to the coastline. Interestingly, one participant described the challenge in updating infrastructure proactively to be more resilient to climate change impacts by saying that it was easier to replace damaged infrastructure than it was to acquire funding to support a new, climate friendly design. Infrastructure might be especially problematic for an island destination with one main access bridge and major attractions accessible by oceanside roads. Another example is Thunder Hole, a popular attraction in ANP involving a viewing platform that allows visitors to get close to the water and peer into a crevice of roaring water. This platform has already been damaged, repaired,

and replaced after intense storm events. A participant from ANP sums up how more frequent storms resulting from climate change poses a challenge for park resources and management decisions:

"We're already saying, talking about 'Do we really want to replace it?'[…] But if we take out all that infrastructure and just add a viewing platform on top, it's not going to stop people from going down and peering into the hole. So are we gonna have more people falling in the water? (Marcus, NPS)"

Marcus' quote also draws attention to the potential differences in risk perceptions between tourism managers and visitors to ANP. He describes a scenario where visitor risk perceptions of having an accident on the rocky cliffs surrounding a popular tourist attraction are likely lower than those of managers who have experienced these sorts of visitor accidents before.

Interview participants also expressed experience with warming temperatures and described the impacts on seasons. Interview participants described a warmer fall season and more mild winters (warmer and less snow on average). The extension of the shoulder season for increased visitation was viewed as an opportunity created by climate change, although also potentially a challenge in terms of management. For example, one business owner reliant on students to meet staffing needs thought it would be difficult to find staff for an extended fall season after school starts. Another NPS participant described challenges in adjusting the timing and length of seasonal staff positions to shifting visitation and the changing natural resource base, a process that requires going through numerous bureaucratic steps and a sizable shift in management processes.

4.4.1.2 Changes in Wildlife

In addition to extreme weather events and seasonal shifts, several interviewees (8) had experienced changes in wildlife, describing these observations in both positive and negative

terms. For example, the area is in danger of species shifting north as average annual temperatures increase and as the Gulf of Maine experiences rapid warming. Though the rapid warming of the Gulf of Maine is difficult to experience first-hand, it was referenced in news articles (Trotter, 2016) and acknowledged by several participants. An observable impact in ocean warming was species shifts, and birds, whales, and fish were described as shifting their ranges, the timing of their migrations, and their feeding patterns by both suppliers and archival evidence (Fisichelli, Monahan, Peters, & Matthews, 2014; Garcia-Navarro, 2019). Shifts related to charismatic marine species, such as whales, seabirds, and lobsters, were especially concerning for some participants (though not all who were concerned had directly experienced these changes) as they thought about Maine's fishing industry and wildlife viewing tours. Some northern moving species were described as being invasive. No references were made to invasive wildlife species, but invasive terrestrial and aquatic plants were described as potentially problematic to the presence and abundance of native species. Conversely, a few species were noted to be moving into the area, providing opportunities, like new birding attractions. Interestingly, three participants acknowledged that wildlife was increasing due to environmental restoration efforts (e.g., dam removal, higher water quality standards) that alleviated negative ecological legacies. Though not discussed by participants, it could be that some species described as shifting north due to climate change may actually be returning as ecological integrity increases in previously degraded systems. These experiences seemed to contribute to tourism suppliers' perceived threats to tourism and outdoor recreation.

4.4.2 Threats to Tourism on MDI

4.4.2.1 Changes to the Natural Resource Base and Potential Health Risks

Tourism suppliers described changes to the natural resource base as the primary climate threat and the resulting negative impacts to the local economy. Participants described high levels of concern for impacts on the marine economy, the potential loss of iconic species like lobsters, the opportunities associated with the arrival of new species, and the impacts to wildlife viewing tourism operators. William's business currently incorporates lobsters into his wildlife viewing tours. He describes the potential loss of lobsters in near shore waters and acknowledges the impact their disappearance might have on his business model; however, William remains optimistic and anticipates that other wildlife species would create viewing opportunities should Maine's lobsters become scarce or disappear.

If there aren't lobsters around then a lobstering tour is probably not going to do terribly well. [I]f species move we may not see as much of them. But in theory others would move in, so I'm not sure if that's a deal breaker. (William, Nature-based tourism business owner)

Interview participants acknowledged that there might be opportunities associated with some of these marine changes, but there was also uncertainty with predicting changes to the Gulf of Maine. Three participants acknowledged that the ocean waters were warming at an alarming speed, which was supported by newspaper articles and scientific reports referencing the Gulf of Maine, and the uncertain consequences of that rapid water temperature increase were concerning in relation to the marine economy, including fishing and outdoor recreation tours (e.g., wildlife species becoming harder to find).

Half of interview participants (12) described the increase in ticks and resulting spread of tick-borne illnesses on MDI. Participants described seeing more ticks on themselves, their family members, and their pets. In addition to posing health concerns for participants and their families

as they recreated outdoors, there were also concerns that ticks posed a threat to visitors who would not be educated about ticks and might become ill after traveling to MDI. As described by Lucas, this was especially a concern for visitors who are unfamiliar with ticks, preventative measures, and the risks of tick-borne illnesses that occur in the northeastern U.S.A. He describes how visitors might be bitten by a tick while on vacation without their knowledge of this event occurring and developing symptoms of tick-borne illness only after returning home.

"I think it's an unaddressed epidemic on MDI and other communities that's really serious, and especially here because we have a tourist economy and people won't even know that they're being infected." (Lucas, Municipal Official)

This concern is not unfounded as cases of tick-borne illnesses, such as Lyme and Anaplasmosis, have been on the rise in Maine since 2001, and symptoms can be mistaken for a variety of other ailments, including the flu or the common cold (Maine CDC, 2020). Several participants (7) connected the recent increase in tick populations to climate change and increased habitat suitability, while one participant described his concern for the effects of tick increases on moose populations but did not connect the potential decline in moose to tourism.

Similarly, when asked to evaluate a list of climate change threats to outdoor recreation in the area, 82.91% (N=359) of visitors indicated that increased presence of ticks was a top threat, followed by increased mosquitos (76.79%, N=331) (Table 10). Given that 35.39% of visitors (N=166) indicated hiking/backpacking as their primary activity, it is perhaps not surprising that nuisances like ticks and mosquitoes were ranked as the highest threats to outdoor recreation. A previous study in ANP found that visitors perceived an increase in ticks and mosquitoes as two of the most likely climate change impacts to affect MDI in the next ten years (De Urioste-Stone et al., 2015). Similarly, visitors also indicated that increased presence of mosquitos was the most likely factor to decrease the amount of time spent recreating outdoors (49.88%, N=213), closely

followed by increased tick numbers (47.64%, N=202) (Table 11). Tourism suppliers (2) rarely mentioned mosquitoes or mosquito-borne diseases as a threat.

Table 10. Perceived visitor threats (percentages).

Please rate the following climate change factors based on your perception of this as a potential threat to tourism in Acadia National Park:	High threat	Threat	Not a threat	Unsure	N
Increased presence of ticks	31	52	11	6	433
Increased presence of mosquitoes	26	51	13	10	431
Extreme weather events	21	55	15	9	432
Heat waves	24	47	20	9	427
Higher temperatures	24	47	23	7	429
Increased ran	14	49	22	15	428
Species extinction	14	48	27	12	428
Disease outbreaks	17	44	19	20	432
Increased ice storms	11	44	27	19	431
Lower temperatures	7	31	45	17	429

Numbers may not sum to 100 due to rounding.

Table 11 Threat influence on visitor recreation behavior (percentages).

How likely are the following factors to influence your decision to recreate outdoors in ANP?	Increased recreation	No change	Decrease recreation	I don't know	N
Disease outbreaks	0	26	61	12	423
Increased presence of mosquitoes	1	44	50	5	427
Increased rain	1	46	48	5	424
Increased presence of ticks	1	46	48	5	424
Extreme weather events	1	44	47	8	427
Heat waves	2	45	46	6	424
Higher temperatures	3	55	34	8	425
Species extinction	1	76	13	10	427
Increased ice storms	1	55	33	11	423
Lower temperatures	5	66	20	8	425
Disease outbreaks	0	26	61	12	423

Numbers may not sum to 100 due to rounding.

4.4.2.3 Extreme Weather Events and Infrastructure

The combination of rising sea levels and increased extreme weather events were high level threats for interview participants in relation to infrastructure on the island. This is not surprising given the previous experience tourism suppliers have with extreme weather and infrastructure challenges. Because MDI is a coastal island destination, many homes, vacation rentals, roads, and fishing infrastructure (e.g., boats, docks, processing areas) are located along the ocean. Additionally, there is one primary access point onto the island, a bridge for vehicles. As one participant describes,

[W]e're vulnerable because there is one road on the island that also carries our phone and power supply. And a stretch of that road is very low to sea level, at the head of the island. So, a hurricane came and knocked out that or like knocked out a bunch of trees at one of our campgrounds. Or otherwise damaged our coastal infrastructure. It could be, managing the emergency locally could be difficult. (George, NPS)

This single point of access, if damaged would create problems for visitors and tourism suppliers who live off island trying to enter or exit MDI, as well as emergency services located on the mainland.

Visitors also perceived extreme weather events as high threats for ANP. Of those surveyed, 76.69% (N=327) indicated that extreme weather would be a threat. Interestingly, 71.43% (N=305) of visitors thought heat waves would also pose a threat to the area. While interview participants had experienced higher annual temperatures, little reference was made to heat waves or drought. Findings from a 2014 survey found that visitors believed MDI to be vulnerable to extreme weather events, sea level rise, damage to roads, power outages, and heat waves (De Urioste-Stone et al., 2016). In the same study, survey participants indicated that increased rain, increased temperatures, sea level rise, extreme weather events, and hurricanes were top threats to tourism and outdoor recreation on MDI (De Urioste-Stone et al., 2016).

In our study, almost half of visitors (47.31%, N=202) thought extreme weather events would decrease the amount of time they spend recreating outdoors in ANP, while 46.23% (N=196) of respondents signaled a likely decrease in recreation as a result of heat waves (Table 11). Interview participants were not specifically asked about infrastructure, but two business owners commented on needing to install or run air conditions for the comfort of guests and the high cost of electricity associated with air conditioning. Higher average temperatures were acknowledged by visitors as a threat to the area (70.63%, N=303 indicated as a threat), with 34.35% expecting their outdoor recreation time to decline as a result. It appears that interview participants were aware of and experiencing increasing temperatures, but they did not consider them to be a top threat, though the association between rising temperatures and higher visitation was concerning for some interviewees.

4.4.2.4 Overcrowding

With visitor numbers rising in ANP and the expected increase in visitation as the climate warms (Fisichelli et al., 2015), interview participants discussed the observed increase in visitation and concerns about overcrowding. Especially contentious was the increasing number of cruise ship arrivals around the island and the decision by two local towns refusing to become cruise ships ports (Southwest and Northeast Harbor) (Schauffler, 2017; Trotter, 2017). MDI is currently in the development phase and perhaps entering the consolidation phase of Butler's Tourism Area Life Cycle (TALC) whereby the area is highly reliant on tourism and the industry continues to expand (Butler, 1980); however, participants and archival evidence report overtourism at times ("[O]n MDI probably the biggest issue right now is overcrowding"), increased pressure on the natural resource base ("So you have more visitation here and less money to maintain the effects of the heavy visitation"), and local irritation with the number of

tourists visiting the destination ("Southwest Harbor becomes second town on MDI to temporarily ban cruise ships"), pointing to shifting toward the stagnation stage (Sambides, 2017). As one participant described,

I think the discussion around [economic development] is changing, as well, into I think a little more sustainable economic development. People are beginning to wonder how much is too much in terms of tourism. Probably in association with the higher and higher numbers of people coming to the park. And also the cruise industry. (Heather, Tourism Non-Profit).

The destination will have to decide how to maintain its competitiveness and long-term attractiveness. We may already be seeing how ANP and Bar Harbor are alleviating the negative impacts associated with overcrowding in an attempt to avoid stagnation and potential decline. Some participants (8) on MDI described being overrun by tourists during the summer, traffic jams, a lack of parking, and some high traffic areas being closed due to overcrowding, an issue that was featured in local newspapers (Kidder, 2015; Miller, 2016). Previously, the Island Explorer bus system was developed to help reduce car traffic in the park; however, this bus system is already often at maximum capacity during peak summer months. In response, the National Park Service is refining and testing a reservation model for high traffic areas in ANP. The town of Bar Harbor, a gateway community to ANP and the primary docking point for cruise ships, is also implementing a new parking reservation system (Kidder, 2015). While still in the testing phase, this initiative could help MDI prolong the development and consolidation phases in the TALC and maintain destination attractiveness.

4.4.3 Behavioral Adaptation and Mitigation

In this section we examine tourism suppliers' and visitors' behavioral responses to climate change threats. We focus on suppliers' adaptation and mitigation actions and visitors' intention to substitute.

4.4.3.1 Tourism Suppliers' Adaptation and Mitigation Behaviors

Tourism providers were considering or already employing a range of climate change adaptation or mitigations measures on MDI. The most frequently discussed behavioral responses to climate change involved hardening up infrastructure, changing approaches to ecosystem management, and considering local renewable energy projects to mitigate emissions.

Both suppliers and visitors indicated their concerns that extreme weather events would impact infrastructure and access to services, such as roads, power outages, and movement to and from the island. It is unsurprising that tourism suppliers discussed infrastructure improvements as a primary strategy in adapting to climate change impacts and, in several instances, as approaches to mitigation. Given past experiences with extreme weather events, a handful of interview participants (5) focused on the impact of intense precipitation events, either through intense rain events or storm surges, to island infrastructure. One participant described how the frequency of 100-year precipitation events is happening more commonly and that ANP is finding ways to "move a lot more water that comes more frequently and more viciously."

They are events that are happening much, much more frequently. So, some of our work around erosion and managing for that, and managing for connectivity in streams, for example, is to understand hydrologic change and to engineer systems, infrastructure that can accommodate those high-higher flows and more frequent flows. (Alyssa, NPS)

Ongoing projects addressing water flow issues included replacing culverts, planning for erosion on hiking trails and roadways, vulnerability assessments for coastal infrastructure, and climate change scenario planning.

These actions point to shifts in managing natural and cultural resources for the NPS and conservation non-profits. For the NPS, incorporating scenario planning and vulnerability assessments helps address areas of climate change uncertainty, while projects that restore

biophysical systems help foster general ecological resilience and ecosystem services. Suppliers experienced species shifts, often attributed to the rapidly warming Gulf of Maine and the changes in average annual temperatures. It is not surprising that suppliers, given their experiences with shifting species, talked about changes to wildlife and shifts to the natural resource base as a top threat to economic activities on MDI. Concerns for ecological integrity perhaps motivated suppliers to engage in restoration efforts projects to improve ecosystem resilience.

While tourism suppliers were focused on threats to the natural resource base and changes to wildlife, visitors were less concerned about these changes. Activities that rely on the presence of specific species, such as birdwatching (0.21%, of our sample N=1), eating lobster (1.71% of our sample, N=8), and wildlife viewing (0.43% of our sample, N=2), made up a very small proportion of our sample, so visitors might not have been thinking about the loss of particular wildlife and plant species in the same way that tourism managers were; however, 61.45% (N=263) of visitors indicated that species extinction was a threat to ANP. Wildlife moving in, wildlife moving out, and species extinction were somewhat likely threats from a 2014 ANP visitor survey (De Urioste-Stone et al., 2016). Based on our survey, species extinction was not expected to have a large effect on recreational pursuits with only 13.35% (N=57) of visitors expecting their recreation levels to decrease in the park.

Non-profits and business owners appeared to be shifting the timing of some of their activities, such as seasonal businesses staying open longer into the fall. Tourism suppliers were seeing shifts in visitation, with more visitors coming during the autumn shoulder season as the weather has been more mild recently. The milder fall was viewed as an opportunity for a longer visitor season. Visitors indicated a high likelihood to engage in substitution behaviors, including

visiting ANP at a different time of year (Table 12). Given that visitors intend to engage in a range of substitution behaviors, suppliers will likely continue to experience changes in temporal visitation patterns, as well as spatial and activity substitutions. Suppliers were already experiencing shifts in the timing of visitors and were aware that visitor numbers were increasing, in part because cruise ships continue to arrive in Bar Harbor well into fall (Trotter, 2014a). Several participants also discussed no longer being able to offer certain activities or programs, such as limiting winter educational activities because lake ice is no longer certain or safe for much of the season. Similarly, one business owner described how she avoids tick habitat (grassy or forested areas) and cautions her customers to remain on the rocks or beaches to avoid tick bites. It seems that suppliers are engaging in substitution behaviors for adaptation, including temporal, spatial, and activity substitutions to respond to changing visitor patterns and climate change impacts.

Table 12. Visitor substitution intention (percentages).

If climate conditions were not appropriate for your recreation pursuits in Acadia Nation Park, how likely would you be to do the following?	Very likely	Likely	Not sure	Unlikely	Very unlikely	N
Visit another place in the U.S.	43	41	12	3	1	425
Visit another time of year	25	48	17	8	2	425
Pursue other tourism/recreation activities	21	49	16	11	2	423
Visit another place in the Northeast	25	42	22	10	2	423
Visit another place outside the U.S.	24	31	22	17	6	422
Visit another place in Maine	22	30	28	17	4	427

Question modified from Dawson, Scott, & Havitz (2013). Numbers may not sum to 100 due to rounding.

Tourism suppliers were also aware of mitigation actions happening on MDI, including A Climate to Thrive's renewable energy initiative, called "Solarize MDI," to be independent of

fossil fuels by 2030. Though not specific to the tourism industry, several participants mentioned the ongoing community discussion around renewable energy, and these projects were often the focus of archival news evidence. The installation of solar panels in several nearby locations might have influenced some of the mitigation aspirations described by participants (Trotter, 2014b, 2018). For example, upgrading building energy systems and investing in solar panels were the most discussed mitigation action by NPS participants. Solar projects were receiving media coverage across Hancock county, including the "Solarize MDI" initiative, and there appears to be a general uptick in coastal solar energy projects along the coast of Maine due to more affordable solar panels, a large federal tax credit, and pride in community solar initiatives (Curtis, 2018). These mitigation projects were largely external to the tourism industry, and this initiative was aimed at MDI residents.

Business owners were less likely to discuss mitigation strategies than other supplier groups, but one business owner described an initiative backed by A Climate to Thrive that includes a sustainable membership group. Businesses (of any kind, not specific to tourism) can shift to climate friendly behaviors, such as installing solar panels, using green cleaning products, and/or meeting energy efficiency standards, and receive a certification to help with advertising. It is unclear how widespread this membership is within MDI's tourism industry, but it appears that mitigation actions are being catalyzed by A Climate to Thrive, though many mitigation aspirations remain largely unrealized by the majority of participants. There is likely some overlap in individual solar projects and tourism suppliers, but no industry-wide mitigation projects were discussed by participants as planned or in place or reported in archival evidence.

4.4.3.2 Visitor Substitution Intention

Visitors were also planning to engage in adaptation behaviors, such as spatial and temporal substitutions, should outdoor recreation conditions decline on MDI as a result of climate change. We asked visitors what substitution strategies they would employ should climate conditions no longer be appropriate for their recreational pursuits in ANP (Table 12). The most common substitution behaviors are most likely to be visiting another destination within the U.S. (84.47% very likely or likely), visiting ANP another time of year (72.95% very likely or likely), and pursuing alternative outdoor recreation and tourism activities (70.22% very likely or likely). Interestingly, all substitutions are somewhat likely as over half of respondents indicated these behaviors as either very likely or likely. This aligns with supplier expectations (7) that visitation to MDI will increase as a result of climate change, especially during the shoulder seasons. One participant observed that the extension of the tourism season could help reduce visitor numbers during traditionally peak times, potentially alleviating visitor management issues with crowding (see Table 13 for a comparison of supplier and visitor experiences, threat perceptions, and responses).

Table 13. Similarities and differences between tourism stakeholders' experiences, perceptions of threats, and behavioral responses.

	Tourism Suppliers	**Visitors**
Experiences		
	• Ticks • Extreme weather events • Changing seasons and resulting shift in visitation • Wildlife shifts (changes to range, timing of migrations) • Invasive species moving into the area	• Ticks • Extreme precipitation • Hurricanes and intense storm events • Flooding • Changes in temperatures
Top threats		
	• Changes to the natural resource base and resulting impacts to economic activities • Extreme weather events and impact to infrastructure (roads, homes, docks, island access) • Overcrowding due to increased visitation to ANP	• Ticks and mosquitoes • Extreme weather events • Sea level rise • Road damage • Power outages • Heat waves • Increased temperatures
Behavioral responses		
	• Improving infrastructure (e.g., culvert replacement, erosion control) • Adopting ecosystem management approaches to improve general resilience • Solar energy projects • Changing business operations (e.g., timing of events, program offerings) • ANP planning (e.g., scenario planning, vulnerability assessment)	• Intention to engage in spatial, temporal, and activity substitution

4.5 Discussion

4.5.1 Risk Perceptions of Climate Change

Tourism suppliers had high levels of experience with climate change impacts, notably with extreme weather events and shifts in wildlife. Firsthand experience with climate change often increases risk perceptions and may increase willingness to act in the face of climate change (Broomell, Budescu, & Por, 2015; Horne et al., *in prep*; Milfont, 2012; Pidgeon, 2012; Spence et al., 2012; van der Linden, 2015). In van der Linden's study of climate change risk perceptions, experiential factors accounted for 22% of the variance in risk perceptions (van der Linden, 2015). Similarly, flood experience among UK residents increased concern for climate change and preparedness to act (Spence et al., 2011). Previous experience with extreme weather events, such as hurricanes, heat waves, and floods, in Australia made it more likely that organizations would undertake adaptation measures (Linnenluecke, Grif, & Winn, 2012). Visitor experiences with climate impacts and perceptions of threats can also contribute to higher risk perceptions and intentions to change travel behaviors (De Urioste-Stone et al., 2016; De Urioste-Stone et al., 2015; Huebner, 2012).

Tourism suppliers and visitors perceived extreme weather and increased tick populations as top threats to tourism on MDI (Table 13). While visitors overwhelmingly knew about ticks many were not engaging in appropriate tick prevention behaviors (Soucy & De Urioste-Stone, 2020). The top barrier to taking preventative measures was that it is too warm in the summer to wear long sleeved shirts and long pants (Soucy & De Urioste-Stone, 2020). Given that average annual temperatures are expected to increase tick populations under climate change conditions across the Northeast (Fernandez et al., 2020) and the continued increase in tick-borne illness in Maine (Maine CDC, 2019), outdoor recreations' risk to tick bites will likely continue to increase

in the future. Few studies have examined the effects of tick-borne illness and the effectiveness of visitor management strategies on visitor behaviors. Informing visitors and suppliers of tick habitats and preventative behaviors may be an important step in reducing tick-borne illness for user groups and maintaining the attractiveness of MDI as a destination.

Though visitors were not asked about perceptions of crowding, suppliers' perceived overcrowding as a top threat to tourism on the island. In ANP, visitation is expected to increase in quantity and across seasons, extending what have traditionally been thought of as shoulder seasons (spring and fall) as a result of climate change (Fisichelli et al., 2015). Given that some interview participants described challenges with managing visitors and overcrowding, this issue is likely to be exacerbated under future climate change conditions (Gonzalez, Coromina, & Galí, 2018; Martin, Martinez, & Fernandez, 2018). Perceptions of negative impacts from visitation (e.g., overcrowding, ecological degradation, loss of traditional livelihood and heritage activities) can cause polarized feelings toward tourism, with some residents rejecting tourism, while those who perceive positive impacts (e.g., financial, positive host-visitor exchanges, pride in local hosts) continue to support tourism (Goeldner & Ritchie, 2012; Martin et al., 2018). Willingness to accept more tourists appears to vary across MDI communities as some places have decided to allow cruise ships access while two towns have barred cruise ship dockings.

Crowding can also affect visitor experiences and behavioral adaptations and is a challenge for many seasonal destinations (Abbasian, Onn, & Arnautovic, 2020). In instances where visitors perceive negative impacts to their experience due to crowding, they are sometimes able to adapt by changing their spatial patterns (Charles, Dominique, & Frederique, 2018) and this could alter the distribution of visitors within ANP. Similarly, changes in weather patterns and microclimates are likely to influence the spatial distribution of visitors within protected areas

(Wilkins, Howe, & Smith, *in review*). The combination of changing climate, increased visitation, potential crowding at popular sites, and high substitution intention in our sample will likely influence visitor experiences and visitation management on MDI. Future research examining visitor perceptions of overcrowding on MDI and anticipated behavioral responses, such as substitution actions, could help managers predict changes in visitation and assess support levels for management actions. Further research could also examine residents' perceptions of tourism and perceived positive and negative impacts, an important consideration when thinking of the future competitiveness of the tourism destination.

4.5.2 Behavioral Adaptation and Destination Resilience

Apart from a Climate to Thrive's "Solarize MDI" and eco-tourism certification, there was little discussion about collective adaptation or mitigation strategies among business owners, though interpersonal relationships with other tourism suppliers were described as strong overall. Though scenario planning and vulnerability assessments were undertaken by ANP, most suppliers' adaptation actions were largely reactive to climate change impacts rather than anticipatory. Reactive adaptation tend to be more expensive than proactive adaptations and may not be as effective as adaptations that have been pre-planned (Gray, 2012). A study in rural Hungary where, despite higher levels of experience with extreme weather events, flooding, and drought and concern for climate change, tourism providers were reacting to impacts rather than proactively adapting (Csete & Szécsi, 2015). Previous studies have found that tourism suppliers expected the government to lead adaptation initiatives (Mushawemhuka et al., 2018). This is perhaps related to limited capacities of some tourism businesses to prioritize adaption and mitigation even if they perceive a risk from climate change (Bicknell & McManus, 2006; Hall, 2006; Tervo-Kankare, 2011). In other instances, low climate change risk perceptions and limited

climate change knowledge have been a barrier to climate change adaptation (Horne et al., *in prep*; Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007). In this case, it may be that tourism suppliers felt that ANP, as a federal partner, would lead adaptation efforts on MDI. Additionally, many tourism suppliers believed visitation would continue to increase regardless of climate change, an assumption supported by a recent study (Fisichelli et al., 2015), and it may be that the assurance of continued visitation lowered some tourism suppliers' willingness to adapt and/or mitigate.

Visitor substitution behaviors seem likely, with visiting another destination in the US, changing the timing of visits to MDI, and altering the activities in which they participate being the most likely adjustment to unfavorable climate conditions. Tourists are often described as more adaptable to climate change than suppliers because they are able to substitute the destination, timing, and type of travel experience they have (Gössling et al., 2012). Previous studies have found visitors are likely to engage in a variety of substitution behaviors, though often visitor characteristics and destination attributes influence those behaviors (Dawson et al., 2013; De Urioste-Stone et al., 2015; Seekamp et al., 2019; Wilkins et al., 2018). For example, a recent study of MDI found that visitors with high place attachment were less likely to alter their travel behavior under negative climate conditions than visitors with lower levels of place attachment (Wilkins & De Urioste-Stone, 2018). Another study of visitor behavioral intentions found that highly involved skiers (those more committed to skiing) were more likely to alter their skiing behaviors if climate change resulted in poor skiing conditions (Dawson et al., 2011). Understanding how visitors perceive their risk from climate change and intend to respond is important in aligning management strategies with visitor concerns. Previous studies have found that adaptation measures within a destination have reduced negative visitor perceptions (Atzori et

al., 2018; Bujosa et al., 2018; McCreary et al., 2018). In instances where visitor and supplier perceptions of risks overlap, tourism suppliers can try to adopt adaptation strategies to reduce visitor concerns. For example, supplier strategies to reduce visitor risk to ticks and extreme weather events would likely be viewed as a "win-win" by suppliers and visitors to MDI alike given that both groups perceived ticks as a high threat to outdoor recreation. This "win-win" strategy could be effective on MDI because suppliers have already expressed an interest in or are already adopting adaptation strategies and visitors have expressed concern for climate change impacts to the destination (De Urioste-Stone et al., 2016)

Understanding and being able to anticipate shifts in visitor demand poses challenges and opportunities for tourism suppliers. The ability of tourism suppliers to predict future shifts and trends in visitation is important for adjusting tourism product offerings, such as the types of visitor experiences, the timing of visitor trips, and the best modes of advertising (McCreary et al., 2019). For example, the projected increase in visitor numbers to MDI during the summer and fall months means tourism suppliers will have to shift the timing of their product offerings to capture fall visitors, while also considering how to manage for the increasing number of summer tourists and still provide a high quality tourism experience. Visitor intention to substitute trip activities could provide an opportunity for suppliers to develop new tourism products to capture emerging market segments and diversify their product offerings, which may offer increased stability in the face of unpredictable shocks and stressors related to climate change and other environmental and socio-economic changes. Likely spatial substitution intentions among visitors may also create advantages for suppliers as visitors may spread out to the "quieter" side of the MDI (western "half"), increasing business opportunities for traditionally less trafficked towns. Conversely, areas that have received less visitor traffic in the past will have to potentially revise

visitor management strategies if numbers significantly increase and how best to alleviate negatives impacts to residents and natural resources. Being able to reduce negative climate impacts to visitor experiences while having the resources to take advantage of emerging opportunities enables suppliers to build capacity and destination resilience.

4.5.3 Limitations

June, July, and August are peak visitation months on MDI, though the shoulder seasons are seeing an increase in visitation. Intercepting visitors during spring and fall months would potentially capture a wider variety of visitor perceptions and behavioral intentions. There are also limitations in measuring visitor experience with climate impacts as survey participants may have trouble distinguishing climate change impacts from unrelated environmental changes (Reser & Bradley, 2020). Finally, we use behavioral intention as a proxy for behavior in this study; however, intentions do not necessarily translate into actual behavioral responses (Bitsura-Meszaros et al., 2015; Hestetune et al., 2018; Lise & Tol, 2002). Results from behavioral intention survey questions should therefore be interpreted as a *possible* indicator of visitor behavior.

4.5.4 Conclusion

Climate change will continue to create challenges and opportunities for tourism destinations. Understanding how tourism stakeholders, both suppliers and consumers, perceive their risk from climate change in nature-based tourism settings will be important for understanding shifts in visitation and appropriate tourism management and adaptation strategies that can foster destination resilience. To ensure long-term destination success, it is important to understand how tourism suppliers' and visitors' risk perceptions and behaviors overlap and diverge. The case study methodology allowed us to identify that tourism suppliers and visitors

had overlapping threat perceptions related to tick populations and extreme weather events. These perceptions likely influenced tourism suppliers' engagement in adaptation and, to a lesser extent, mitigation behaviors, though there was little collective action across tourism supplier groups (i.e., business owners, non-profits). Visitors were likely to engage in a range of substitution behaviors if they perceived climate conditions as unsuitable to outdoor recreation on MDI. While our findings indicate overlap between tourism suppliers' and visitors' risk perceptions, a possible area of divergence relates to overcrowding. Tourism suppliers identified overtourism as a threat to MDI as visitation is expected to increase further under climate change projections. We recommend future research examine visitor perceptions of crowding and potential behavioral responses to understand how management within ANP and MDI can reduce the negative impacts on visitor experiences, thereby continuing to align supplier actions with visitor expectations.

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CHAPTER 5: CONCLUSIONS

5.1 Summary of Findings

In this dissertation, we examined factors contributing to coastal climate change resilience in two tourism destinations, the Bay of Machias and MDI. By applying concepts and theories from resilience thinking and risk perceptions, we gain a more holistic understanding of how coastal tourism stakeholders perceive their risk from climate change and what factors shape their behavioral responses that may enhance or limit destination resilience. In chapter 2, we used a phenomenological approach with stakeholder interviews to examine how a rural nature-based tourism destination, the Bay of Machias, leveraged its social, natural, human, and political resources to build destination resilience to climate change through adaptation strategies such as exploring a seawall to address the threat of sea level rise. Financial and built assets were lacking in this destination; however, bolstering resilience was still possible through partnerships, adaptive learning, engaged governance, and leveraging skills and resources, such as grant writing and knowledge, across individuals and organizations.

In chapter 3, we used a quantitative visitor survey to understand predictors of climate change risk perceptions. A hierarchical regression analysis pointed to gender, climate change belief, experience with climate change impacts, and altruistic values orientation as significant predictors of visitor climate change risk perceptions. Measuring determinants of visitor risk perceptions gives us a better understanding of how visitation may shift as a result of climate change. Predicting visitor climate change risk perceptions and behavioral adaptations is important for visitor management, destination attractiveness, and the overall alignment between supplier products and visitor demand needed to ensure destination resilience.

Chapter 4 used a case study with mixed methods to understand how stakeholder risk perceptions and behavioral responses can influence climate change destination resilience on MDI. Visitors and suppliers perceived increased ticks and extreme weather events as high threats to outdoor recreation. Tourism suppliers were also concerned about large-scale changes to the natural resource base that might negatively impact MDI's tourism economy. Both visitors and tourism suppliers were engaging in or planned to engage in adaptation or mitigation behaviors in response to climate change. Visitor intention to substitute location, trip timing, and activities was high, while suppliers were using strategies like changing the timing of business operations, investing in infrastructure, and restoring ecosystems to adapt. Understanding the divergence in stakeholder risk perceptions and behavioral intentions demonstrates potential areas where suppliers will not adapt to visitor expectations, which may decrease the attractiveness of MDI to certain user groups. Conversely, areas where stakeholders' perceptions and behaviors align may indicate where tourism suppliers' actions can alleviate visitor risk perceptions and improve destination appeal, as well as areas where visitors might be willing to pay for adaptation and mitigation initiatives. Predicting visitor trends is also important for enabling suppliers to adapt to emerging opportunities that may arise from climate change (Jopp, Delacy, & Mair, 2010), thus increasing individual and destination resilience.

How do these chapters come together? Both the Bay of Machias and MDI are coastal tourism destinations already experiencing the effects of climate change, such as sea level rise, flooding, seasonal shifts, changes in species, and increases in average annual temperature. Tourism is critical to MDI and is becoming an increasingly important livelihood strategy in the Bay of Machias. Despite these similarities, the Bay of Machias and MDI are very different destinations. MDI includes a national park that receives over 3.5 million visitors annually,

tourism is at the forefront of their economy, and visitation continues to increase. There are also local experiences with overcrowding, an indication that MDI is in the development stage but approaching consolidation (Butler, 1980). The Bay of Machias has fewer visitors but suppliers believe visitation is increasing, making tourism a growing livelihood alternative to traditional industries, though some hesitancy to support tourism remains. These trends represent elements of the involvement phase of the TALC where tourism is slowly increasing, some locals are embracing tourism as a livelihood strategy, and the destination is being advertised; however, interactions between tourists and the host communities remain limited (Mandić et al., 2018).

The stage of development may play a role in influencing a destination's ability to recover from shocks, thereby influencing destination resilience. For example, a study comparing the recoveries in Singapore (consolidation phase) and Vietnam (involvement phase) to SARS found that, while both tourism markets were proportionally impacted by the outbreak initially, Vietnam's tourism economy recovered more quickly (Bojanic, 2003). This difference in recovery rates was explained by the quantity of visitors needed to reach previous visitation levels in Singapore and the novelty (e.g., limited willingness/ability to substitute destination, more rapid innovations occurring) associated with a more developing destination, such as Vietnam (Bojanic, 2003). In contrast, a comparison of Grenada (more developed destination) and Barbados (less developed destination) found that Grenada recovered more quickly from shocks (e.g., economic recessions, the September 11 terrorist attacks) (Bangwayo-Skeete & Skeete, 2020). This was attributed to multiple contextual factors associated with Barbados, including the higher cost of vacations, more restrictive visa requirements, and a less cohesive advertising strategy (Bangwayo-Skeete & Skeete, 2020). As Maine experiences climate change and other

shocks, the stage of destination development and available resources may be important when considering destination resilience and ability to recover.

5.1.1 Risk Perceptions and Community Resilience

There is no shortage of social science concepts and theories trying to predict human behavior. A range of other social and psychological concepts can explain human behavior (or lack thereof), such as social identity, motivation, moral disengagement, psychological numbness, lack of perceived control, place attachment, etc. (Ajzen, 1991; Bamberg, Rees, & Seebauer, 2015; Heberlein, 2012; Peeter, Diependaele, & Sterckx, 2019; Stern, 2018; Wilkins & De Urioste-Stone, 2018). In this dissertation, we focus on risk perceptions as a predictor of behaviors to contribute to a growing number of studies applying risk perceptions theories to tourism and outdoor recreation research. While previous studies have found climate change risk perceptions to predict behavioral changes (Huebner, 2012; Karl, 2018; Perry et al., 2018; Safi et al., 2012; van der Linden, 2015), others have found no connection (Hestetune et al., 2018; Lise & Tol, 2002; Seekamp et al., 2019). We acknowledge that a range of additional social science concepts and theories merit further study in their applicability to explaining cognition and behavioral change within the field of tourism and outdoor recreation.

What is the connection between risk perceptions, measured in this study at the individual level, and community resilience, with "community" referring to the set of communities that are part of a tourism destination (Gunn & Var, 2002)? The theory of panarchy offers details of how systems at all scales are important for maintaining resilience due to the interconnected multiscalar system of feedback loops (Berkes & Ross, 2013). Panarchy acknowledges that socio-ecological systems are comprised of subsystems at various stages of their adaptive cycles and that interactions and feedbacks from these different adaptive cycles are operating at different

temporal and spatial scales (Davidson, 2010). In panarchy, each level of subsystem experiences its own adaptive cycle, but slower and larger scales set conditions for faster, smaller scales, creating a dynamic system of feedbacks (Davidson, 2010). This multiscalar nature is especially important for social systems because we are increasingly living in a globalized and interconnected world. If these social systems rapidly shift discontinuously, there is high potential for system collapse if different systems at different scales all release at the same time (Holling, 2001). This collapse results in maladaptive systems or systems that have lost their ability to create, test, and maintain adaptive capacity to strive for sustainability (Holling, 2001). The interconnectedness of multiscalar systems can help us bridge the gap between the individual (micro) scale with the community (meso) scale as all systems are, rather than being viewed separately, nested and overlapping (Chapman et al., 2017; Holling, 2001).

Though influenced by socially driven pressures, risk perceptions are measured at the individual level in this study. Community resilience goes beyond the individual to influence a group of geographically and socially bound people. How do we reconcile the conceptual differences between these concepts and challenges of scale? There is relatively little research connecting the two concepts, but I will outline my thinking. Risk perceptions influence individual cognition and can result in behavioral responses. These responses can be adaptive to change, increasing individual resilience. This idea of individual resilience applies to both tourism suppliers and visitors. For example, higher risk perceptions might encourage a visitor to respond with a behavior to reduce their risk from climate change (e.g., wearing long pants to reduce risk of tick bites, avoiding flood prone areas), while a tourism supplier might engage in adaptations (e.g., investing in flood resilient infrastructure) or mitigation behaviors (e.g., businesses receiving an eco-certification to differentiate themselves from competition while also reducing

their carbon emissions). This can potentially establish norms if a group of individuals share something in common (e.g., adopt similar mitigation strategies as other businesses in the area, use gear to reduce tick-borne disease risk, vacation at the same destination), but what is the key ingredient that motivates people to act in ways that go beyond benefitting themselves? What might, for example, motivate an individual to adopt behaviors that benefit a collective group of people, such as a community? Perhaps social networks and social capital are concepts that bridge the gap between individual perceptions and collective, resilience-building action.

By social capital, I refer to the assets that make up individual or community networks, which is often referred to as the glue that ties individuals within a community together (Flora & Flora, 2013; Hopkins & Becken, 2014). This directly relates to findings from chapter 2 where strong social networks, partnerships, and skill and knowledge sharing were critical factors influencing destination resilience in the Bay of Machias. Tied up in the notion of social capital is altruism or caring for the wellbeing of others, sometimes discussed as values of self-transcendence (Dietz et al., 2007). We found that altruism was a significant predictor of visitor risk perceptions in chapter 3. It seems likely that altruism influences decisions made by individuals to engage in behavior that benefits a collective group of people, rather than just themselves. Previous studies have found that engagement with climate change is influenced by a range of motivators. For example, higher levels of perceived control, subjective norms, social identity, and individual cost-benefit analysis predicted engagement with collective climate change actions (Bamberg et al., 2015). In another example, European Union environmentally conscious citizens' engagement with extra mitigation behaviors was predicted by attitudes toward both climate change as a threat and the role of mitigation efforts (Ortega-Egea et al., 2014). Once an individual is motivated to act beyond self-interest, how is behavioral intention

translated to behavior? Self-efficacy might be the construct that allows individuals and groups to take action in addressing climate change. Higher self-efficacy is often associated with higher levels of engagement and action while low self-efficacy can result in hopelessness and inaction (Dillimono, 2015; Hertwig & Frey, 2015; Milfont, 2012). Action is likely to arise if individuals believe they are capable of taking an action to address a threat and that their actions will be effective in responding to the threat (Hart, 2013). In both the Bay of Machias and MDI, individuals had high climate change risk perceptions. With few exceptions, tourism suppliers were overwhelmingly concerned about climate change impacts to their destination. In the Bay of Machias, a shared environmental ethos, a strong sense of community, and having knowledge of specific local impacts enabled stakeholders to self-organize and feel empowered to investigate their options. A sense of efficacy facilitated the transition from individual risk perceptions to collective action to address climate change flooding.

We have a more complete picture of the tourism system on MDI, an understanding of both supplier and visitor climate change risk perceptions. There were pockets of collective climate change action happening among MDI tourism suppliers but not necessarily across groups (i.e., business owners, non-profits, ANP). ANP had a clear management strategy focusing on restoring and maintaining environmental integrity to boost ecological resilience to an array of shocks and stressors, including climate change. A Climate to Thrive's "Solarize MDI" and environmental certification program were examples of island community members coming together for joint mitigation, though this was largely separate from the tourism industry. While social networks between businesses were described as strong and overall cooperative, little collective action seemed to occur across business owners in relation to climate change actions. There did not appear to be island-wide climate change resilience projects that involved all

tourism supplier groups. This is somewhat similar to the Bay of Machias where most business owners were aware of the seawall project but not actively involved.

It appears that both destinations have unequal levels of engagement with collective climate change adaptation and mitigation efforts, with business owners being less involved than other types of suppliers (e.g., non-profits, NPS, municipal leaders). This could potentially be explained by the TALC model and competition. Destinations like the Bay of Machias are in the involvement phase where tourism development is new and there are few tourism suppliers. Conversely, MDI is nearing the consolidation phase where tourism has nearly saturated the market and competition between tourism suppliers is high. The limited number of tourism businesses in the Bay of Machias and the competition between businesses on MDI may explain why there was limited collective climate change strategies that included business owners. Bringing business owners into the climate change planning process might be a way to alleviate concerns, provide an opportunity for business owners to self-organize or join ongoing efforts to increase their own business's resilience to climate change, and become part of ongoing destination resilience efforts.

5.2 Research Contribution and Management Implications

In chapter 2, we add to a growing body of literature connecting tourism research with resilience concepts. We conceptualized a small, rural tourism destination as a community, allowing us to apply concepts from the community resilience literature to a tourism setting. We argue that there is overlap between the idea of tourism destinations and community resilience, at least if destinations are smaller and in an earlier stage of development. The Bay of Machias serves as an example for other developing destinations for how tourism suppliers can still leverage the assets in their possession to strive for climate change resilience.

In chapter 3, we used a modified version of van der Linden's social-psychological theory of climate change risk perceptions in a new context, tourism research. Given that we explained 45.5% of the variance in visitor climate change risk perceptions, the model has the potential to be useful in other climate change risk perception studies within tourism research (by comparison, van der Linden explained nearly 70% of the variance in UK residents' climate change risk perceptions) (van der Linden, 2015). Our findings suggest that park managers and tourism suppliers who want to relay climate change information might try relating to visitor experiences with impacts or altruistic message frames, rather than relying on climate change facts. As climate change impacts visitor experiences in ANP, visitors may become a potential resource to fund climate projects that benefit both tourists and residents. Finally, visitors who are aware of climate change are likely to demand more infrastructure and climate adaptation policies. Understanding these visitor risk perceptions and expectations will help tourism suppliers in coastal destinations and national parks adapt to continue to meet visitor expectations, ultimately maintaining the long-term competitiveness of the tourism industry and maintaining the integrity of the natural and cultural resources even as climate conditions continue to change.

Results and insight from the MDI case study presented in chapter 4 help to gain a richer understanding of both consumer and supplier climate change risk perceptions as they relate to destination resilience. By studying risk perceptions of suppliers and visitors, we can see how supply and demand may interact in the context of a changing climate and a changing destination. How these two sides of the economic equation are linked will have implications for the long-term success of tourism on MDI. It does not look like visitation will decline any time soon, but suppliers' ability to anticipate and respond to shifts in demand will influence trip satisfaction, the creation of a new marketing mix (e.g., product development, advertising strategies), and visitor

and resource management. MDI has the advantage of large visitor numbers that make the area somewhat insulated from economic shocks; however, without actively managing for climate change impacts and shifts in visitor perceptions/demand, MDI will face economic challenges related to either overtourism or an eventual decline in visitation. The ability of MDI to work collectively across tourism supplier groups will be important for destination resilience. While this dissertation focuses on destination resilience to climate change in Maine's coastal tourism industry, lessons learned may be applicable to other shocks or stressors, such as disruptions related to COVID-19 and economic recessions.

5.3 Future Research Directions

Future research could focus on finding further ways to apply resilience frameworks to different tourism destinations. Does the concept of community resilience apply to larger, more developed tourism destinations? Future research should consider the size and stage of destination development according to the TALC model and its influence on available assets and pathways to climate resilience. For example, destinations in the later stages of development (consolidation, stagnation) likely have more financial and built resources than destinations in earlier stages of development (exploration, involvement); however, developing destinations are often characterized as being more innovative. How does resource availability change the types of capitals tourism suppliers can use to build destination resilience? Additionally, as higher visitation is a characteristic of later stages of development, how do visitor numbers influence destination resilience strategies?

Additional constructs that might improve the strength of our model in chapter three include affect, norms, and trust in climate change communication sources (Heberlein, 2012; Mase et al., 2015; van der Linden, 2014). It would also be interesting to continue visitor

sampling into the fall season to compare differences between summer and fall user groups. It could be that visitors are already shifting the timing of their visits to ANP to take advantage of the more mild, less crowded fall season. Capturing fall visitor perceptions and behaviors would yield a more comprehensive understanding of visitation shifts.

While we focused on climate change risk perceptions in chapter 4, other variables likely influence stakeholder perceptions and decisions to adapt and/or mitigate. In terms of visitation, measuring consumer perceptions of crowding would complement our understanding of climate change risk perceptions and the influence high visitation has on destination resilience. While visitation is expected to increase in ANP under climate change projections, it could be that overcrowding alters visitation behaviors more than climate change impacts. It appears that some tourism suppliers are concerned about overcrowding and the impact on visitor experiences, residents' quality of life, and environmental and cultural resource bases. Assessing perceptions of crowding among residents, not just tourism suppliers, will be important to understand local support for continued or increased visitation to MDI, a consideration that may be especially important in determining MDI's TALC trajectory (i.e., decline or rejuvenation). It would also be interesting to better understand mechanisms that enable tourism suppliers to work collectively to engage in more adaptation and mitigation behaviors. What types of island-wide initiatives would appeal to all groups of tourism suppliers, and how can business owners be better integrated into these collective strategies, thereby improving resilience to climate change impacts?

5.3.1 Messaging Experiment and Pile Sorts

We included a messaging experiment in the survey of visitors to ANP. Participants were randomly assigned into three message groups: health, weather, and no message. The health message warned of the risk of increased exposure to Lyme disease as a result of climate change

increasing habitat suitability on MDI. The weather message warned of flooding to low lying areas of ANP as a result of increased extreme weather events caused by climate change. While we hypothesized that those who received a health message would have higher risk perceptions than those who received a weather message or were part of the control group, there was no significant difference between groups. We have no way of knowing the cause of this finding; however, one possible explanation is that our sample indicated high levels of concern for climate change in general and specified increased ticks and extreme weather events as high-level threats to recreation on MDI. It is possible that risk perceptions for both these specific climate change threats were already high in our sample and our messages could do little to influence these perceptions. In the future, it would be interesting to compare higher ranked threats (e.g., ticks, extreme weather) to lower ranked threats (e.g., lower temperatures, ice storms) to see if message frames highlighting different impacts affect risk perceptions.

Each face to face interview included a pile sort activity where participants sorted cards with environmental and social conditions into clusters. COVID-19 necessitated a switch to remote interviews, thereby preventing pile sorts from being included in phone interviews. We conducted a multidimensional scaling (MDS) analysis in SPSS to approximate what participants were thinking while sorting cards (Bernard, 2011). The MDS graph presents a visual mental map depicting the relationship between card terms, with lower stress levels indicating a better solution or fit between the graph and the data (Bernard, 2011). The stress values for participants in the Bay of Machias and MDI were higher than 0.2, well over the range of acceptability (0.1-0.15) (Borgatti, 1998). This could indicate that participants in each destination were not using similar sorting criteria or that our sample size was too small to be able to comment on common approaches to sorting. A higher sample size was needed to be able to draw conclusions.

5.4 Working with an Interdisciplinary Team

As a member of the National Science Foundation's National Research Traineeship (NSF-NRT) conservation science program at UMaine, I have been working with an interdisciplinary team of graduate students on biophysical and social science research related to climate change. Being a member of this team has enhanced my capacity as a researcher in multiple ways. Firstly, my ability to communicate across disciplines has greatly improved. Our team of four, two biophysical and two social scientists, while all working on climate change, approach climate research differently. Differences in disciplinary languages and unfamiliarity with theories and methods posed a challenge for our group; however, we have created an atmosphere where we encourage asking questions and have become used to thinking about how to explain something in multiple ways. Ultimately, learning how to communicate across disciplines has been practice for when we start to communicate with community partners outside of academia to co-develop tourism planning workshops. Being deliberate with language, avoiding jargon, and conveying the crux of the message are all key things my team and I have learned in the months working together. Another skill gained from working with an interdisciplinary team is learning how to find intersections between different research projects. As a team, we had to start thinking about the "big picture" and once we settled on a research idea that conceptually combined our projects, we had to take a more detail-oriented approach to consider how our research could be braided together so that all elements were cohesive. This approach involved expanding my project to look for areas where my data can be combined with other projects to create a more holistic understanding of how climate change is impacting the tourism industry. Working with an interdisciplinary team also involves thinking about what skills and knowledge every team member brings to the table and how these can be combined to create a highly effective team.

With complex problems like climate change, interdisciplinary research teams allow for a more comprehensive understanding of the problem and a broader range of solutions. As I continue to work with and learn from this interdisciplinary team, we will have opportunities to translate our research into actionable solutions for Maine communities by becoming a transdisciplinary team and collaborating with community partners.

5.5 Overall Conclusions

We combine risk perceptions and resilience thinking to gain a better understanding of how climate change is impacting tourism destinations along the coast of Maine, which may impact future destination sustainability. Our use of mixed methods ensures that this research is bound by the local contexts of the Bay of Machias and MDI. Why should we care about the local when climate change is a global phenomenon? Our use of qualitative methods gives voice to groups who are often under-represented in research, especially those living in rural, economically depressed areas. A local scale is critical to understanding local climate change realities as different units of analysis will give researchers a more complete picture of how socio-ecological systems are connected across scales (Aswani, 2011). A community or destination research focus helps us link the micro-, or individual, scale to the macro-scale, often thought of as national or global in size (Silka, 2018). By studying the local, we understand the "on the ground" lived realities of participants, communities, and destinations as they grapple with climate change as a macrophenomenon. Our understanding of the local scale contributes to our broader understanding of the global climate system.

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APPENDIX A: SAMPLE INTERVIEW GUIDE

I would like to begin by asking you for some background information about your business.

1. Could you tell me about your business?
    a. What is it?
    b. What activity/activities/services is/are offered?

For this next section, I'm going to ask you about your views on environmental changes and what factors have shaped those opinions.

Before we talk about that though, I'd like to do a quick activity called a pile sort. I am going to provide you with a pile of cards that have different environmental conditions written on them. I would like you to group them into piles using whatever criteria you want. There can be as many piles as you would like and you can place cards in their own individual pile if you would like. There are also blank cards that you can add additional environmental changes that you would like to include. When you have the cards in their piles, please also create names for the piles. Please take as much time as you would like.

2. Could you explain why you decided to put the cards in this particular order?
    a. How are the cards in this pile related?
    b. What are the differences between these piles?
    c. Were there any that you wished could go in multiple piles?
    d. Why did you decide to add this environmental condition?
    e. Have you experienced any of these environmental changes first hand? If so, could you describe which changes you have experienced?
        i. How do you think that first-hand experience has influenced how you think of climate change?
3. Do you think that other business owners/community leaders (stakeholders) are aware of climate change?
    a. What, if any, actions do you see other stakeholders taking to address climate change?
    b. How do their actions influence the way you think about climate change?
4. How concerned are you about climate change?
5. How informed do you feel you are about climate change?
    a. What do you feel like you need to understand more about for CC?
6. What kinds of sources do you receive information about climate change from?
    a. Why do you use these sources?

Now I'd like to ask you about some of the challenges, threats, and opportunities you see your business encountering due to environmental and climatic changes.

7. Would you say that climate change is affecting your business?
    a. If so, what changes have you seen?
8. What climate change risks do you see your business facing in the future?

a. Do you think your community will be affected in the future?
b. How will the environment be affected in the future?

9. How might climate change help your business?

For this last section, I would like to ask you about any potential mitigation and adaptation strategies your business is employing or thinking of employing.

10. Are there any changes your business has made in response to climate change?
11. Are there any changes your business intends to make to adapt to climate change?
    If so, could you please describe these changes?
12. Are there any changes your business has made to reduce your climate (environmental) impact?
13. Are there any changes your business intends to make to become more climate (environmentally) friendly?

APPENDIX B: PILE SORT TERMS

Adaptation
Animal and plant disease outbreaks
Carbon dioxide emissions
Changes in seasons
Climate change
Consumption
Crime
Deforestation
Drought
Economic development
Erosion
Fire
Fishing
Flooding
Habitat fragmentation
Heat waves
Human disease outbreaks
Human health
Human migration
Hurricanes
Ice storms
Infrastructure
Invasive species
Loss of biodiversity
Mitigation
Mosquitoes
Ocean acidification
Overdevelopment
Overhunting and over fishing
Pesticide, herbicide, and fertilizer runoff
Pollution
Poverty
Power outages
Rain
Resilient
Rising sea level
Scenery
Snow
Species shift
Temperature change
Terrorism
Ticks
Tourism
Transportation
Travel
Water pollution

APPENDIX C: IRB APPROVAL

APPLICATION COVER PAGE

- ***KEEP THIS PAGE AS ONE PAGE – DO NOT CHANGE MARGINS/FONTS!!!!!!!!!***
- ***PLEASE SUBMIT THIS PAGE AS WORD DOCUMENT***

APPLICATION FOR APPROVAL OF RESEARCH WITH HUMAN SUBJECTS
Protection of Human Subjects Review Board, 400 Corbett Hall

(Type inside gray areas)

PRINCIPAL INVESTIGATOR:	**Sandra De Urioste-Stone**	**EMAIL: sandra.de@maine.edu**
CO-INVESTIGATOR:	**Lydia Horne**	**EMAIL: lydia.horne@maine.edu**
CO-INVESTIGATOR:		**EMAIL:**
FACULTY SPONSOR:		**EMAIL:**
(Required if PI is a student):		

TITLE OF PROJECT: **Fostering Coastal Community Resilience in Maine: Understanding Climate Change Risks and Behavior**

START DATE: **October 2017** **PI DEPARTMENT:** **School of Forest Resources**

FUNDING AGENCY (if any): **NOAA**

STATUS OF PI: FACULTY/STAFF/GRADUATE/UNDERGRADUATE F (F,S,G,U)

1. If PI is a student, is this research to be performed:

- ☐ **for an honors thesis/senior thesis/capstone?**
- ☐ **for a doctoral dissertation?**
- ☐ **other (specify)**
- ☐ **for a master's thesis?**
- ☐ **for a course project?**

2. Does this application modify a previously approved project? N (Y/N). If yes, please give assigned number (if known) of previously approved project:

3. Is an expedited review requested? Y (Y/N).

Submitting the application indicates the principal investigator's agreement to abide by the responsibilities outlined in Section I.E. of the Policies and Procedures for the Protection of Human Subjects.

Faculty Sponsors are responsible for oversight of research conducted by their students. The Faculty Sponsor ensures that he/she has read the application and that the conduct of such research will be in accordance with the University of Maine's Policies and Procedures for the Protection of Human Subjects of Research. REMINDER: if the principal investigator is an undergraduate student, the Faculty Sponsor MUST submit the application to the IRB.

Email this cover page and complete application to UMRIC@maine.edu

****

FOR IRB USE ONLY **Application # 2017-09-13** **Review (F/E): E Expedited Category:**
ACTION TAKEN:

- X☐ **Judged Exempt; category 2 Modifications required? yes Accepted (date) 9/27/2017**
- ☐ **Approved as submitted. Date of next review: by Degree of Risk:**
- ☐ **Approved pending modifications. Date of next review: by Degree of Risk:**
  Modifications accepted (date):
- ☐ **Not approved (see attached statement)**
- ☐ **Judged not research with human subjects**

FINAL APPROVAL TO BEGIN **9/27/2017**
Date

01/2017

APPENDIX D: SURVEY INSTRUMENT

Default Question Block

Dear Acadia Traveler,

You are invited to participate in a research project being conducted by Lydia Horne, a graduate student, and Dr. Sandra de Urioste-Stone, an assistant professor at the University of Maine. The purpose of this research is to better understand your views on environmental risks to the natural environment, such as climate change, in coastal Maine. You must be at least 18 years of age to participate.

What will you be asked to do?

If you decide to participate, you will be asked to fill out the following questionnaire, which will take approximately twenty minutes.

Risks

Except for your time and inconvenience, there are no risks to participate in this study.

Benefits

While this study may have no direct benefit to you, this research will help us learn more about the impact climate change has on outdoor recreation. This information will be useful in long-term planning and decision-making for outdoor recreation and tourism.

Compensation

At the end of the survey, you will have the opportunity to enter your name into a raffle for one of three $50 L.L.Bean gift cards. You must reach the end of the survey to enter the raffle.

Confidentiality

Your responses for the survey will be confidential. A key will be used to keep track of who has responded to the survey so that reminders are not sent unnecessarily. Please do not type your name anywhere on the questionnaire. The data will be stored on a secure electronic database and the key will be stored using software that provides additional security. The key will be kept until Fall of 2019. All data will be kept until Fall of 2023.

Voluntary

Participation is voluntary. You may stop at any time or skip questions. Starting the survey implies consent to participate.

Contact Information

If you have any questions about this study, please contact:

Lydia Horne
PhD Student
Ecology and Environmental Sciences
University of Maine
umainerec@gmail.com

Dr. Sandra De Urioste-Stone
Assistant Professor
School of Forest Resources
University of Maine
(207) 581-2885
sandra.de@maine.edu

If you have any questions about your rights as a research participant, please contact:

Gayle Jones
Protection of Human Subjects Review Board
University of Maine
(207) 581-1498
gayle.jones@umit.maine.edu

Thank you for taking the time to complete this questionnaire!

Section 1. This section deals with your recent travels to Acadia National Park, when you were contacted by the research team, and the activities in which you participated.

What was the primary purpose of your most recent trip to Acadia National Park? ***(Please check one)***

- ○ Business
- ○ Just passing through
- ○ Vacation
- ○ Visiting friends/family
- ○ Staying at seasonal residence in Maine
- ○ I'm a permanent resident of the area
- ○ Other *(please specify)* _____

How would you describe your travel party? ***(Please check all that apply.)***

- ☐ Co-workers
- ☐ Family
- ☐ Friends
- ☐ Self
- ☐ Other *(please specify)* _____

How many people were in your travel party? (*Please include yourself in this number.*)

_____

How many children (under the age of 18) were in your travel party?

_____

Was this your first trip to Acadia National Park?

- ○ Yes
- ○ No

Which activities did you participate in during your most recent trip to Acadia National Park? ***(Please check all that apply.)***

- ☐ Arts or cultural activity
- ☐ Backpacking/hiking
- ☐ Biking
- ☐ Birdwatching
- ☐ Boating (motorized)
- ☐ Camping
- ☐ Canoeing/kayaking
- ☐ Climbing
- ☐ Concert or festival
- ☐ Culinary tour (includes beer and wine tours)
- ☐ Eating lobster
- ☐ Fishing
- ☐ Hunting
- ☐ Geocaching
- ☐ Golfing
- ☐ Picnicking
- ☐ Photography
- ☐ Shopping
- ☐ Sightseeing/driving for pleasure
- ☐ Spa activity
- ☐ Swimming/beach activities
- ☐ Walking
- ☐ Wildlife viewing
- ☐ Other *(Please specify)* _____

What was your primary leisure activity (the activity in which you spent the most time participating)? ***(Please check only one.)***

- ○ Arts or cultural activity
- ○ Backpacking/hiking
- ○ Biking
- ○ Birdwatching
- ○ Boating (motorized)
- ○ Camping
- ○ Canoeing/kayaking
- ○ Climbing
- ○ Concert or festival
- ○ Culinary tour (includes beer and wine tours)
- ○ Eating lobster
- ○ Fishing
- ○ Hunting
- ○ Geocaching
- ○ Golfing
- ○ Picnicking
- ○ Photography
- ○ Shopping
- ○ Sightseeing/driving for pleasure
- ○ Spa activity
- ○ Swimming/beach activities
- ○ Walking
- ○ Wildlife viewing
- ○ Other (*Please specify*)

Section 2. In this next section, we are interested to learn more about your beliefs and perceptions of the environment and global changes.

Please indicate the extent to which you agree or disagree with the following statements.

On average around the earth, I believe the following are happening:

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	I don't know
Drought is becoming more common	○	○	○	○	○	○
Air temperature is increasing	○	○	○	○	○	○
Ice in the Arctic is now thawing	○	○	○	○	○	○
The amount of snow in mountains is decreasing	○	○	○	○	○	○
The number of flooding events is increasing	○	○	○	○	○	○
Sea level is rising	○	○	○	○	○	○

Please indicate the extent to which you agree or disagree with the following statements.

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree	I don't know
The hole in the ozone layer causes climate change.	○	○	○	○	○	○	○	○
I know a lot about climate change.	○	○	○	○	○	○	○	○
Humans contribute to climate change.	○	○	○	○	○	○	○	○

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree	I don't know
Climate change is currently happening.	○	○	○	○	○	○	○	○
Climate change is a natural fluctuation in earth's temperatures.	○	○	○	○	○	○	○	○

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree	I don't know
Climate change is caused by heat trapped by cities.	○	○	○	○	○	○	○	○
Tourism contributes to climate change.	○	○	○	○	○	○	○	○
Carbon dioxide emissions contribute to climate change.	○	○	○	○	○	○	○	○
We are not experiencing climate change because not all places are getting hotter.	○	○	○	○	○	○	○	○

The following statements address your views of climate change. Please indicate the extent to which you agree or disagree with the following statements.

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree	I don't know
Most people I care about believe in climate change.	○	○	○	○	○	○	○	○
Most people I care about are personally doing something to reduce the risk of climate change.	○	○	○	○	○	○	○	○
The government should be in charge of addressing climate change impacts/concerns.	○	○	○	○	○	○	○	○
We can all do our part to reduce the effects of climate change.	○	○	○	○	○	○	○	○
Climate change will benefit my community.	○	○	○	○	○	○	○	○

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree	I don't know
I will only do my bit to reduce climate change if everyone else does as well.	○	○	○	○	○	○	○	○

	Strongly agree	Agree	Somewhat agree	Neutral	Somewhat disagree	Disagree	Strongly disagree	I don't know
Climate change is inevitable because of the way modern society works.	○	○	○	○	○	○	○	○
It is already too late to do anything about climate change.	○	○	○	○	○	○	○	○
The actions of individuals have little impact on climate change.	○	○	○	○	○	○	○	○

Section 3. This section is concerned with your personal experiences with the environment and global changes.

Please check all of the environmental issues that you have personally experienced during your lifetime:

- ☐ Air pollution
- ☐ Changes in precipitation
- ☐ Changes in temperature (heat waves, more severe winters, etc)
- ☐ Climate change
- ☐ Flooding
- ☐ Hurricanes/tropical storms
- ☐ Infectious disease
- ☐ Overpopulation (of the earth by humans)
- ☐ Pollution of rivers and seas
- ☐ Rising sea levels
- ☐ Tornadoes
- ☐ Wildfires
- ☐ Others *(please specify)* _____

Please check all of the environmental issues that you <u>expect to personally experience in the next ten years</u>:

- ☐ Air pollution
- ☐ Changes in precipitation
- ☐ Changes in temperature (heat waves, more severe winters, etc)
- ☐ Climate change
- ☐ Flooding
- ☐ Hurricanes/tropical storms
- ☐ Infectious disease

- [ ] Overpopulation (of the earth by humans)
- [ ] Pollution of rivers and seas
- [ ] Rising sea levels
- [ ] Tornadoes
- [ ] Wildfires
- [ ] Others *(please specify)*

How likely are the following impacts of climate change to affect Acadia National Park in the next 10 years?

	Very unlikely	Somewhat unlikely	Likely	Somewhat likely	Very likely
	0	25	50	75	100
More extreme weather events					
Increased species extinction					
Reduced snow					
Longer summer season					
Increased presence of ticks					
Increased presence of mosquitoes					
More ice storms					
More heat waves					
More disease outbreaks					
More tourist visitation					
New species coming to Acadia National Park					

Other *(please specify)*

Block 2

You will now be asked to read a short paragraph and answer several questions immediately after.

Block 4

Climate Change and Lyme Disease in Maine

Scientists believe that climate change is already affecting the state of Maine by contributing to the spread of deer ticks and Lyme disease in Maine. Lyme disease is primarily transmitted to humans through infected deer ticks, which attach themselves to outdoor recreationists. Most cases are currently reported in southern and coastal Maine; however, the range of deer ticks has been moving north along the coast and up the major river valleys. Climate change models show that all of Maine will have conditions conducive to Lyme disease by 2080.

To reduce your exposure to deer ticks, please wear long pants when recreating outdoors, stay on hiking trails, and check your body for ticks after being outside.

The message you just read was about:

- ○ Ticks
- ○ Flooding
- ○ Snowfall levels
- ○ Heat waves

How persuasive was this message?

- ○ Very persuasive
- ○ Persuasive
- ○ Neutral
- ○ Not persuasive
- ○ Not persuasive at all
- ○ I don't know

Block 2

Section 4. In this section we would like to understand your current and intended travel behaviors.

Please rate the following climate change factors based on your perception of this as a potential threat to tourism in Acadia National Park.

	High threat	Threat	Not a threat	Unsure
Extreme weather events	○	○	○	○
Species Extinction	○	○	○	○
Increased presence of ticks	○	○	○	○

	High threat	Threat	Not a threat	Unsure
Increased presence of mosquitoes	○	○	○	○
Increased ice storms	○	○	○	○
Higher temperatures	○	○	○	○
Lower temperatures	○	○	○	○
Increased rain	○	○	○	○
Heat waves	○	○	○	○
Disease outbreaks	○	○	○	○

How likely are the following factors to influence your decision to recreate outdoors in Acadia National Park (i.e., decrease/no change/increase the amount of time you spend recreating outdoors at Acadia National Park)

	Increase recreation	No change	Decrease recreation	I don't know
Extreme weather events	○	○	○	○
Species Extinction	○	○	○	○
Increased presence of ticks	○	○	○	○
Increased presence of mosquitoes	○	○	○	○
Increased ice storms	○	○	○	○
Higher temperatures	○	○	○	○
Lower temperatures	○	○	○	○
Increased rain	○	○	○	○
Heat waves	○	○	○	○
Disease outbreaks	○	○	○	○

We would like to learn more about what values are important to you. For each value listed below, please rate the extent to which you consider it to be a guiding principle in your life.

	Of extreme importance	Very important	Quite important	Slightly more than important	Important	Somewhat important	Of little importance	Not important at all	O…
Preventing pollution	○	○	○	○	○	○	○	○	
Promoting peace	○	○	○	○	○	○	○	○	
Protecting									

	Of extreme importance	Very important	Quite important	Slightly more than important	Important	Somewhat important	Of little importance	Not important at all	O t v
the environment									
Having social power									

	Of extreme importance	Very important	Quite important	Slightly more than important	Important	Somewhat important	Of little importance	Not important at all	O t v
Being helpful									
Having authority									
Having social justice									
Respecting the earth									

	Of extreme importance	Very important	Quite important	Slightly more than important	Important	Somewhat important	Of little importance	Not important at all	O t v
Being influential									
Being unified with nature									
Having equality									
Being wealthy									

If climate conditions were not appropriate for your recreational pursuits in Acadia National Park, how likely would you be to do the following?

	Very likely	Likely	Unsure	Unlikely	Very unlikely
Visit another place in Maine					
Visit another place in the Northeast					
Visit another place in the US					
Visit another place outside the US					
Visit in another time of year					
Pursue other tourism/recreational activities					

Section 5. This final section of the survey will give us some background information about you. Your answers to these questions, as with all other answers you provide in this questionnaire, will remain completely anonymous.

What is your gender?

- ○ Male
- ○ Female
- ○ Other
- ○ Prefer not to answer

What is your age?

When it comes to politics...

	Very conservative	Conservative	Neutral	Liberal	Very liberal
I consider myself to be...	○	○	○	○	○

What is your highest level of education?

- ○ Less than high school
- ○ High school graduate
- ○ Some college
- ○ 2 year degree
- ○ 4 year degree
- ○ Master's
- ○ Doctorate
- ○ Professional degree
- ○ Vocational degree

What is your combined annual household income? *(Please check one)*

- ○ $0-$25,000
- ○ $25,001-$50,000
- ○ $50,001-$75,000
- ○ $75,001-$100,000
- ○ $100,001-$125,000

- ○ $125,001-$150,000
- ○ $150,001-$175,000
- ○ $175,001-$200,000
- ○ $200,001 or greater

Are you from the US?

- ○ Yes
- ○ No

What is your zip code?

What country are you from?

Please enter the identification number on the invitation letter mailed to you. This will help us avoid sending you a reminder to participate in our survey and will not be connected to your responses in any way.

Thank you for your time! Please feel free to add any additional comments regarding the survey.

If you would like to enter your name into the L.L.Bean gift card raffle, please click the following link:
https://umaine.qualtrics.com/jfe/form/SV_1T81Y2LyGDFVV9X

Block 3

You will now be asked to read a short paragraph and answer several questions immediately after.

Climate Change and Flooding in Maine

Scientists believe that climate change is already affecting the state of Maine by contributing to the increase in coastal flooding in Maine. The Gulf of Maine is especially vulnerable to flooding from sea-level rise and higher levels of precipitation. Climate change models show that Maine may experience more flooding, erosion, and major storm events by 2080.

To reduce your exposure to flooding dangers, please avoid beaches and other low-lying coastal areas during storms, look for washouts and debris in the road, and avoid getting too close to storm surge.

BIOGRAPHY OF THE AUTHOR

Lydia Horne is originally from Maine. She was born in Bangor on July 14, 1991 and grew up in the woods of Holden, Maine. In 2009, she graduated from John Bapst Memorial High School in Bangor, Maine with a love for science, music, and languages. Lydia then went on to St. Lawrence University in Canton, NY where she graduated with a Bachelor of Science in Conservation Biology and minors in Anthropology and French. After working as a seasonal field technician for the University of Maine's Entomology and Wildlife Ecology departments, as well for Oklahoma State University's Department of Zoology, Lydia returned to Maine to pursue her Master of Science in the School of Forest Resources. In May of 2017, with her Master of Science from the University of Maine in hand, she began her PhD in Ecology and Environmental Sciences at the University of Maine. Lydia is also a member of the University of Maine's National Science Foundation's National Research Trainee conservation science program. Lydia is a candidate for the Doctor of Philosophy degree in Ecology and Environmental Sciences from the University of Maine in December 2020.